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EDUCATION FOR MANAGEMENT

IT is a sobering thought that there are between 400,000 and 450,000 persons in the United Kingdom engaged at the present time in management—and that nearly all of them are doing that important job by the light of nature. It is human nature to "boss" someone else; but that is not management. Attractive advertisements point the way through a door with "MANAGER" (sometimes "MANAGER—PRIVATE") upon it, inferring thereby that that position is the summit of human ambition and that those who sit in the manager's chair are happy indeed. Now the manager has a very responsible job to do, a job that rolls into one all the separate jobs that the undertaking's staff has to do. The manager has a personal responsibility for the conduct of his undertaking or company; he holds the strings of affairs in his person and it is he who must plan and organize for success. The collective managers of all the firms in the nation are ultimately responsible for the welfare of everyone; an ill-managed business cannot be successful and unless the businesses of the nation are managed successfully, the nation cannot prosper. We should not dream of putting at the head of a laboratory a clerk who had shown a certain aptitude for leadership; special technical and scientific knowledge are essential. Similarly no gas engineer would expect a fitter—fit he never so well—to manage his drawing office; technical skill of a particular kind is needed for that. But how blithely we put in charge of an undertaking an engineer or an accountant because he has proved himself a good engineer or a good accountant.

Discoursing upon Mr. Tate's Paper on management a few weeks ago we made the point that there should be conscious training for management; managers may be born with the ability to acquire managerial skill, but the skill to manage in the modern sense of the word is not inherited. Like other forms of skill it must be acquired by painstaking study and often painful experience. There is no one yet who has not learnt more from his failures than from his successes, but if the number of failures needed to create experience can be reduced by imparting knowledge in advance, the better it is for everyone concerned. America, so often in advance of the European Continent, has gone in for management training in a big way, supported by the American Management Association. The Wharton School of Finance and Commerce at the University of Pennsylvania was founded way back in 1881. During the years 1898-1901 seven more business schools were established and in the next ten years the number was increased by a further dozen, including the Harvard Graduate School of Business Administration. Between 1910 and 1930 a further 180 schools were established. The Balfour Committee on Industry and Trade (in 1924) reported that in the U.S.A. there were as many as 80,000 students attending 100 of the schools or departments of business administration or commerce "a figure out of all proportion to the few hundreds attending similar courses in this country." This difference has increased since that report was published. Thousands of young men go into industry annually in the U.S.A. with some intellectual preparation for and an established concern with management principles. These facts are vouched for by a Committee appointed by the Minister of Education in October, 1945, whose report has just been issued by the Ministry concerned. They deserve the careful attention of all who have the subject of expert management at heart.

This timely report should lead to immediate action to put management upon a sound basis of professional training. It is made clear in the report that it is not to be expected that young people—of either sex, even though most women are born managers of men—can become managers in industry or commerce by following courses of theoretical study. Theory and practice must go hand in hand. Many professional institutions require a knowledge of management and set examinations on that subject. Some of the senior engineering institutions are beginning to incorporate a few administration questions in their examination papers. But there are specialist bodies dealing with various aspects of management, many of which require an examination in the subject to be passed before a person can be regarded as "qualified" in a particular field. There is considerable confusion in that all these bodies have different syllabuses, and require different types of training. The Committee has endeavoured in its report to suggest means whereby there should be arrangements for common syllabuses. "That action," says the report, "is necessary if multiplication of courses in management is not to dissipate national facilities which are already inadequate." The professional institutions are, therefore, urged to include in their syllabuses as large a common management content as possible and confine specialized demands in this field to the essential minimum.

PREPARING FOR RESPONSIBILITY

WE shall not attempt to follow the report through all the educational proposals made by the Committee. It may be noted, however, that the educational side of preparation for managerial responsibilities involves no small an amount of study. First there must be a background of general education to an adequate standard as the foundation on which to build. There are then "background subjects" required to provide the basis for the study of management in any particular field; these may include, in business for example, the History and Structure of Industry and Commerce, Economics, Industrial and Commercial Law, and Psychology. There is also an important group of "tool subjects," with which the manager should be conversant, though not necessarily acquiring a high degree of skill in their use; among these the Committee mentions Accounting,

Statistical Methods, Production Methods, Work Analysis and Incentives, Costing and Financial Control, and Office Organization and Method. This seems a large mouthful, but we have not yet reached the "Management Subjects," These are: The evolution of management, a study of the six main activities of management—forecasting, planning organizing, commanding, co-ordinating, and controlling—and the management methods applicable to each of the major activities of business, namely, Production, Distribution, Finance, Development, Purchasing, Transport, and Personnel Management.

The foregoing, it will be conceded, is a pretty hefty list. Management, it will be suspected, is a whole-time job—as indeed it is. Much depends on how deeply the various subjects are to be studied. To gain a reasonable knowledge of all these subjects must demand whole-time study for some considerable period; a full University course would not be too long to devote to it. Unfortunately, one cannot just set out to be "a manager," as one sets out to be a chemist or an engineer. Some can never manage anything, no matter how they prepare themselves for the job, because management requires experience as well as knowledge; and it requires special personal characteristics which may not be acquired but can only be developed if they are already present. "Management," therefore, can never be more than a part-time study because the future manager must be earning his living and gaining his experience for years before he can be translated to the managerial chair. Thus Management Training must be essentially a topping-up superimposed upon professional qualifications in some other branch. The Committee seems to have recognized this, for the report advocates that no one should be allowed to take the Final examination until the age of 25 or 28 has been attained, and that the courses should be taken as part-time courses by those who are already working full-time in their normal occupations; the student should not be required to spend more than 100 working hours a year on the management course.

The management of every concern must do its share in training the managers of the future. It is not enough to let a young man pursue his normal work and to take these courses. It should not be impossible to pick out at a comparatively early age those who show indications of possessing qualities of leadership and initiative and to give them special facilities for learning by experience. Every one works better when he has some degree of responsibility; in assuming that responsibility a man can begin to acquire the habit of leadership. Managers *may* be born, but we doubt very much whether that is the whole story. Environment is a formative force as powerful as is heredity. Environment can be given to a suitable man by his employer. Given environment, however, training in the subjects here mentioned is essential if a man aspires to the higher branches of management.

It is very difficult to decide who has the ability to acquire the art of management. We have said that those who are suitable can be picked out at an early age; so they can to some extent, but not all those who seem to be good managers in embryo turn out to be so in practice and when they are of riper experience. Meanwhile, the misfits are wasting their time. Trial and error, with perhaps assistance from applied psychology, provide the only yardstick. None the less, if employers will give their staffs the opportunity to practise on the works what they are learning about management at the evening classes, the period of trial and error can be reduced. The Committee has come to the conclusion that "no system of tests or comprehensive examinations, however careful or objective, is a fully satisfactory determinant." That to our mind is a reason why management should take very seriously the problem of training future managers, and should provide facilities for training by experience in their own organizations. The Gas Industry is no worse than other industries in this respect, and is perhaps better than many; but there is room for improvement and the direction of improvement has perhaps been sufficiently indicated in the Careers Book of the Institution of Gas Engineers.

A FUEL PLAN

THOUGH many useful and thought-provoking suggestions have been made, no one has yet, we think, put forward a completely comprehensive plan to ensure the utilization of our fuel resources with the maximum efficiency. Perhaps the nearest approximation was that of Mr. Oliver Lyle in the remarkable Paper "Inefficiency" which he presented to the Institute of Fuel last year, and about which we wrote in the "JOURNAL" of March 20, 1946. "All the brains are not in Whitehall" has become something of a cliché, but it is true that fuel technologists should not wait for the Government to plan for them—there is too much waiting for the Government to plan. They should get on with the hammering-out of one or more plans so that they can be fully considered before the time comes to put one or other of them into action. Mr. Lyle's proposals are well worth another perusal. In a fascinating analysis of existing practice he came to the conclusion that the grand overall efficiency of coal-getting and using is 15% and he advanced suggestions in some detail which he estimated would raise this to 28% with a possible annual saving of 80 million tons of coal. "Any estimate of possible saving is, of course, open to objections from all sides, but there is no harm in trying." No harm indeed; it is most urgent and important that we should get on with this trying, if only to drag the objections out into the light so that we can see what can be done to meet them.

Mr. Lyle's estimates begin with power production and use. Perhaps enough has been said about that, but one or two omissions are to be noted. There is, first, the usual failure to differentiate between the several kinds of coal used, particularly the main division of (a) coals which should be processed (carbonized) before use, and (b) those which are not, at present, worth such treatment. The latter, only, should be used raw for power generation. Then there is the equally usual failure to realize that district heating does not solve the whole problem of domestic heating. No sort of economy is claimed for it except in conjunction with power stations. Mr. Lyle sees a possible saving of 21 million tons in power stations "and miscellaneous industries." He would secure 9 millions by the electrification of the railways and 5½ millions by improvements at the collieries.

The present efficiency of domestic heating is estimated at 15%, and in this and other forms of industrial and space heating Mr. Lyle's treatment is inadequate—which is not surprising in view of the immense field he attempted to cover in one, not very long, paper. Some of the elements of the problem are touched upon, insulation is recommended, heating by electricity is deprecated, but there is no attempt to estimate what could be saved by a radical re-design of house-heating and of houses for efficient heating. Still, here are proposals which, estimated without the slightest tendency to exaggeration, would save 37½ million tons of coal in the generation and use of power, 23 millions in the domestic field, nearly 12 millions in industrial heating, and a total of 81,400,000 tons a year, which Mr. Lyle scales down to 80 millions.

It is, naturally, when we turn to the consideration of the necessary policies to enforce these savings that we enter debatable ground. "Research is, in many industries, far ahead of full-scale application." So that is not the way! Co-ordination of effort is more promising. There is no profit in "rubbing-in" the absurdity of the misuse of electricity, but if gas and electricity are to come together on a new "Energy Commission" we must see to it that the division of service is fixed on a technical and not on a financial

basis. It is coal-cost which is now important—that is, the cost of the service in pounds of coal (and pounds of the right coal), not in pounds sterling. But if there is to be any manipulation of prices, one would like to know just what the Exchequer experts think of Mr. Lyle's suggested excise duty on coal. Can it, in view of the recent exploit with the tobacco duty, be laughed out of court? At any rate we may hesitate whether or not to agree with the view that some form of compulsion is necessary to economize fuel "sufficiently quickly to save our grand-children or even ourselves" from the dire effects of a dwindling supply of reasonably cheap coal. Posterity will never forgive us if we go on wasting 85%.

COMPLETE GASIFICATION

THE criticism that has been directed to the work of the Gas Research Board has fallen upon its total gasification programme. Here there are two schools of thought. One, having the existing state of affairs in mind, declares that total gasification is so far in the distant future—since the demand for solid smokeless fuel is likely to continue for generations—that it is a waste of resources to devote so much time to it. The other is convinced that the sooner the Gas Industry gets away from solid fuel the better, and that in any event it is highly desirable that the Industry should as soon as possible have complete control over the proportions of coke and gas made. We shall not take sides in this particular controversy at this juncture, but one consideration must not be overlooked.

Research must have a floor but no ceiling. There must be a solid basis for the work and the Board must keep its feet firmly on the floor. On the other hand, the scope of research should be as wide as it is possible to make it. Most gas engineers—and this applies to those who have the management of works in almost every industry—must keep their feet on the floor and must not allow their gaze to wander too far from their immediate problems and duties. It is the duty of a research association to allow its eyes to scan the distant horizon and to fasten its gaze upon the heavens. Those with the right vision can foresee the future trends in industry and in social life and can plan ahead to meet them. It may be necessary to devise new processes of making gas, new methods of using gas, new standards of gas service. What will be the result of the coming of atomic energy on the Gas Industry? Those who bid the Gas Industry to keep to "practical" problems would be the first to complain bitterly if, should atomic energy become appliable for power generation, they lost their employment. It is the function of the Gas Research Board to look ahead to possibilities of this kind and to endeavour, by long-range research, to meet them before they arise.

The scope of research must not be circumscribed by any demand for immediate practical results. Early in this comment we emphasized the value of pure research and the possibilities that are inherent in research of that character. Research, we have said, should be conducted to a plan—a plan drawn up by the far-sighted. But, as Dr. King himself once said (Melchett Lecture, Institute of Fuel, 1944): "Somewhere in the pattern of any organized research there must always be space for the individualist whose discoveries of new facts or quick recognition of their application should act as a recurring stimulus to the advance of organized research."

It may well be that the practical gas engineer, with the essential limitations of his training as conceived to-day, may not always understand the studies that are being made unless they are put before him by someone who is adept at explaining in common words the intricacies of the problem and its means of solution. This makes it necessary that the pattern of organized research should be so explained. It does not make it necessary that the pattern of organized research, as laid down by a competent Board with the Director, should be changed. There must be a happy blend of investigation into problems of present urgency, into problems of future urgency, and in long-range research. It is our impression that the Board is now engaged on such a programme, and although we should desire to add further problems to those now under investigation we recognize that there is to-day a severe shortage of qualified research staff, and that the Board has yet no adequate accommodation. Meanwhile, we suggest that those who have specific problems or who desire particular problems to be tackled should communicate with the Director of Research. They may be surprised at the amount of help that they can obtain instanter.

Personal

Mansfield Town Council has selected Mr. H. C. KEYWOOD, of Leicester, to fill the appointment of Deputy Gas and Water Engineer in succession to the late Mr. J. Sims.

* * *

Mr. W. EDGAR HALE, of Walsall, has been appointed Chairman of the South Staffordshire Mond Gas Company and of its subsidiary companies, Melanoid, Ltd., and Monsol, Ltd. Mr. Hale has been closely connected with the Company for 22 years, most of the time as Vice-Chairman.

* * *

Mr. J. R. PORTER, Works Manager at South Shields gas-works for 20 years, has been transferred in a similar capacity to the Redheugh gas-works of the Newcastle-upon-Tyne and Gateshead Gas Company. Mr. Porter, was Superintendent for six years at Jarrow gas-works before going to South Shields.

* * *

Mr. ALEX. AULD, Technical Assistant, and Mr. JAMES GILL, General Works Foreman, two long service employees of Aberdeen Gas Department, were recently presented with wallets of notes by the staff and foremen to mark the occasion of their retirement. Mr. Auld joined the Aberdeen Gas Department in 1903, and Mr. Gill in 1902.

* * *

After serving for six years in the Army, Mr. A. R. TURNER, son of Mr. R. Turner, General Manager and Secretary of the Bedford District Gas Company, has been appointed Assistant General Manager of the Company. Mr. Turner was articled at Bedford and from 1938 until joining the Army in 1940 he was with the Boston Gas Light and Coke Company.

Obituary

Mr. GEORGE CATTO, who was for many years a leading figure in Aberdeen's municipal affairs, died suddenly at Woodend Hospital, Aberdeen, last week. Mr. Catto was for some time Convenor of Aberdeen Gas Committee, and since his resignation from the Town Council in 1941 had occupied the position of Local Fuel Overseer.

* * *

In the "JOURNAL" last week we recorded with regret the death of Mr. P. Parrish.

Dr. E. V. Evans, Managing Director of the South Metropolitan Gas Company, writes:

The death of Mr. Percy Parrish means to the South Metropolitan Gas Company the loss of an irreplaceable officer and to the Chemical Industry the loss of a unique and competent chemical engineer. If the title of Chemical Engineer connotes the technician who is capable of transferring chemical reaction from the laboratory to the large scale, and to that end designs, erects, and operates plant which, day in and day out, yields a product of constant characteristics, then Parrish was indeed a Chemical Engineer. He entered this Company's service 32 years ago as Manager of the Inorganic Chemical Works. At the time of his death it is no exaggeration to claim that he was renowned as an expert in the working-up of by-product ammonia. He was also an authority on the manufacture of sulphuric acid. At the time of his appointment a pressing problem facing the Company was the necessity of manufacturing sulphate of ammonia as a well-defined crystal containing so little impurity that it would neither cake on storage nor rot the sacks in which it was to be transported and stored. Parrish studied the question in conjunction with our chemical staff, and his competency was shown by his ability to reproduce in the large scale plant the precise conditions required. His work on the design of a simply operated plant for the concentration of ammoniacal liquor is known to many gas engineers. By such concentration transport of ammoniacal liquor over long distances

becomes an economic proposition and such installations should play an increasingly useful role in the future, for it is to be conceived that with the integration of the Gas Industry, sulphate of ammonia will be manufactured mainly in large centralized installations. These are two of many examples of Parrish's achievements.

In many ways Mr. Parrish was a remarkable man. Himself a great worker, he expected this attribute in those under his control. By his staff of men he was highly respected; respected not only for his forthrightness and sense of justice, but also because men knew that he was himself capable of doing any task which he asked others to perform, whether it were the writing of a specification for the erection of a Gay Lussac tower or the stoking of a hand-fired boiler.

I know I am expressing the opinion of Directors, staff, and workpeople of this Company by stating that we have lost, with the deepest regret, a valiant and most respected officer. In my own case it is an honour to be allowed to pay tribute to the memory of a colleague whose integrity, competence, and achievements evoked our deep admiration.

Letters to the Editor

"Moving Wartime Gasholders"

DEAR SIR,—Probably few are in a better position than the writer to reply to Mr. Gill on the above problem.

During the 1914-1918 war, the writer supervised the manufacture and erection, also the final testing, of several gasholders which were intended, some for airship inflation, and others for illumination and power. Some of these he had to meet again and supervise their re-erection in quite a distant district, as illuminating and cooking gasholders. At a result of these duties, he feels he can safely assure Mr. Gill that to bolt together gasholders likely to be transferred elsewhere would not be wise or economical.

When gasholders are being finally assembled in the gas-works for the remainder of their useful existence, a number of "tacking" bolts are necessary to keep the sections in correct relative position, where bolts of ½ in. dia. or larger are suitable. After the bulk of the structure is so held together, the permanent rivets can be put in and finished off much more quickly and cheaply than bolts. Further, the rivets, if finished quickly and correctly, will shrink as they cool and draw the laps together more tightly than bolts would, especially if some modern type of workmen is employed. Cold-driven rivets of $\frac{5}{16}$ in. and ¼ in., if correctly hammered, are more reliable and gastight than bolts could be.

Bolts, nuts, steel and fabric washers are much more expensive than rivets and the subsequent painting of these is more expensive to carry through. Another, and a serious, consideration is that bolts used on side sheets of inner lifts and on the inner edges of the dips of outer lifts would reduce the clearances between the lifts (which often average 3½ in. to 2½ in.). This would, doubtless, mean dangerous contact, which, in a spiral guided gasholder, would result in disaster. See Fig. 1.

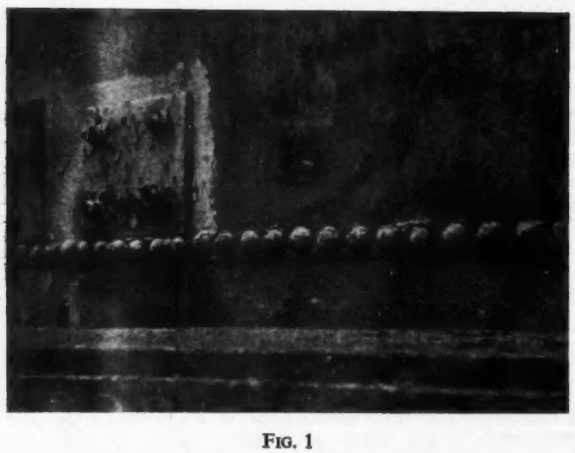


FIG. 1

Bolts projecting from the inner lift of a guide framed holder. The bolt ends are bent upwards by contact with the inner edge of the dip. What would happen if bolts were opposite, pointing inwards, to meet these?

Ladders bolted close to inner lift sheeting have been torn off the lift when the average space was 3½ in., and the ladder sides 2 in. by ½ in. only. One can imagine how dangerous bolts, projecting ½ in. from each side, inwards, in a 3½ in. irregular space can be if the gasholder be a spiral. See Fig. 2. If ice is allowed to form on the surfaces of tank and cup waters of a spiral holder, the ½ in. bolts of the rotating portion compete with the stationary part and its similar bolts, in pulverizing the ice. No doubt Mr. Gill has in mind the damage that may be done by careless men when taking the demobilized gasholder to pieces. This must be prevented. The writer has at the present time three gasholders (all recently used for hydrogen) to inspect and report upon. He recommends the possible purchaser to stipulate that the same contractor who dismantles shall re-erect. This, to deter the first from damaging or seriously distorting the sections when cutting adrift. Another two-lift spiral, in steel tank, has just passed final tests. The original cold riveting was defective, due to the rivets being short. The re-erected lifts have rivets ½ in. longer and the improvement is obvious to view and to test for gas tightness. The steel tank was originally "hammer" riveted outside. The re-erected tank has been "hammer" riveted inside, where riveting was required. The whole of the gasholder was tested under its maximum working pressure.

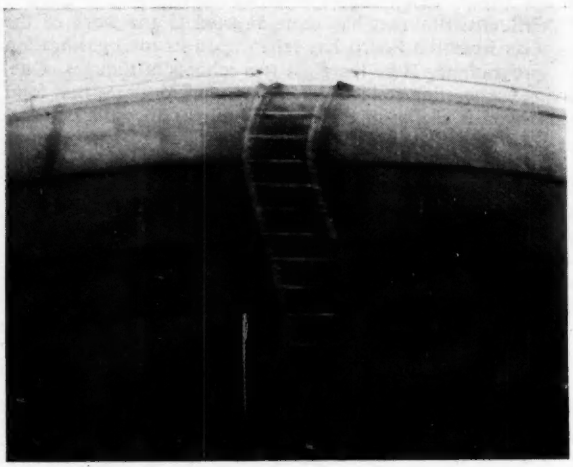


FIG. 2

Ladder on a spiral guided holder bent in narrow annular space between inner lift and dip.

Before the sheeting was re-erected the edges, which had been riveted previously, were flattened carefully to remove any crooks —all old paint and painted tape were cleaned off and the sheets painted. They had been cut from their positions in twos or threes.

Prices asked for these second-hand holders—about 6 or 7 years old, and including dissecting, removing, and re-erecting, are little less than for a new one, erected.

Yours faithfully,
LEONARD BOTT.

Leonard Bott, Ltd.,
15, Holyhead Road.
Wellington, Shropshire.
May 29, 1947.

British Gas Council (Scottish District)

DEAR SIR,—Several factors have contributed to the fact that there is not yet a Home Service Adviser Service in Scotland. With the end of the war and the progress, slow though it is, in the new housing position, several undertakings are showing a genuine interest in Home Service Adviser work.

Undertakings in Scotland, with few exceptions, are small and their size does not justify the carrying of unnecessary staff. The Scottish District of the British Gas Council has, therefore, drawn up a panel of three free-lance lecturer-demonstrators whose services are available to all member undertakings. Despite the small fee charged to undertakings the scheme is almost self-supporting financially and has been so successful that the Scottish District is sending one of the demonstrators on a Home Service Adviser Course in June. She will then tour the country and her efforts will be used as a yardstick whereby

to gauge the potential of a full-time Home Service Adviser in the areas visited.

The demonstrations already given have been very successful, drawing large audiences and capturing the attention of the local Press, who have given valuable publicity. The main difficulty in employing free-lance demonstrators was their lack of knowledge to act as gas publicists, but that was overcome by the ready co-operation of the manufacturers who took great trouble in giving the necessary instruction. Great credit also reflects on the individual members of the panel.

Yours faithfully,

48, West George Street, Glasgow, C.2.
June 3, 1947.

A. M. SIMPSON,
Secretary.

News in Brief

George Wilson Gas Meters, Ltd., have started production in their new factory built on the Bede Estate between Jarrow and South Shields. This is the first factory to begin work on the estate.

An Expenditure of £122,995 on the provision of oxide purification plant at **Birkshall** gas-works has been proposed by Bradford Gas Committee, but the Estimates Sub-Committee has adjourned consideration of it pending submission of more detailed information.

Owing to the Continued Rises in the cost of coal, materials and wages, the Wolverhampton Gas Company is applying to the Minister of Fuel and Power for permission to increase the price of gas. The increase to domestic consumers to take effect from the June reading of the meters is 0.889d. per therm, or 4d. per 1,000 cu.ft.

After a Six-hour Strike by employees of Stonehaven Gas Company the men agreed to return to work pending further discussions on their wage grievance. Directors of the Company state that they are paying higher wages than the Joint Industrial Council recommended, but the men are seeking adjustment because of the reduction of hours from 50 to 44 hours per week, and also on the question of up-grading.

Additional Gas Plant is to be installed at Aberdeen at a cost of over £130,000. This step has been taken following proposals to the Gas Committee by Mr. H. S. Milne, Engineer and Manager, that due to the mounting demand for gas in the city, the present plant will, in a few years' time, be unable to meet the demand. Production of gas this year is expected to be about 2,420 million cu.ft., or 529 million cu.ft. more than in the last pre-war year. The new plant will not be completed for about four years.

The Joint Efforts of the Mansfield and Chesterfield authorities to meet the increasing demand for gas supplies in the two areas, which led to a recent conference with representatives of the Ministry of Fuel and Power and the National Coal Board, were outlined in a memorandum presented to the Mansfield Town Council. The memorandum referred to the 20 years' agreement made in 1935 with the Grassmoor Colliery Company to afford all its gas requirements. It was agreed that the two authorities and the N.C.B. should examine details of the scheme and report their findings.

Skegness Urban District Council's rate advance of 8d. has only been kept down to that figure by the fact that the Council received £3,750 war distress grant, and the taking of £1,070 from the profits of the gas undertaking. The latter was a somewhat unexpected "windfall" as owing to the increased consumption of gas the trading surplus on the undertaking for the last financial year was £4,500 against an estimated surplus of £45. In consequence of this result the price of gas is to be reduced, a block scale of charges having been agreed upon by the Gas Committee in place of the present sliding scale. The amended charges take effect from the meter readings for the quarter commencing in July.

"Radiant House"—the mobile homecraft centre organized by the Edinburgh Gas Department—has now moved to the Sighthill district of Edinburgh after being at Muirhouse for a month, when a total of 1,097 housewives attended the centre. "Radiant House" will remain at Sighthill for a month and cookery demonstrations by the staff of the Ministry of Food Advice Centre will be organized, and lectures on cookery, housecraft, make-do-and-mend, and gardening will also be given. Councillor West Russell, Convenor of the Corporation Gas Sub-Committee, presided at the opening ceremony of the centre at Sighthill, which was performed by the Lady Provost, Miss Diana Falconer.

Dr. Taylor (Mayor of Bolton) has declined to support an appeal to local householders to make a voluntary cut in gas and electricity of 25% because "it is out of touch with reality." He has written to the Regional Controller for the Ministry of Fuel and Power saying so. The Ministry's Regional Officer stated that "to safeguard our winter fuel supplies and avert a repetition of last winter's crisis, the Government want a 25% voluntary saving from each household." Dr. Taylor replied that he was not prepared to set up such a committee for this cause. He was satisfied that "the real shortage and hardships householders had had to suffer had in themselves caused great privation and a committee to secure further drastic economies would be totally ineffective. Local enthusiasm for such a cause was out of touch with reality."

To Improve Gas Pressure at peak periods, March (Cambs.) Gas and Coke Company propose the erection at Norwoodside of a compressing plant with two high-pressure tanks having a capacity of 10,000 cu.ft.

Spalding Urban District Council approved the installation of new gas plant and ancillary works at the Spalding gas-works as well as new distribution systems for both Spalding and Holbeach. The cost of the scheme will amount to some £74,000. Work is expected to commence on the plan next year.

The United Kingdom Gas Corporation has arranged for the erection of a new gasholder at the works of the Harrogate Gas Company in order to increase the storage capacity by 2 million cu.ft. The work of excavating and preparing the foundations has now been started by the F.C. Construction Co., Ltd., of Derby. Costing £55,000, the new holder is to be built by Clayton, Son, & Co., Ltd., Leeds.

Common Ground, Ltd., has now published three film-strips dealing with the Gas Industry. Each strip is of approximately 80 pictures, and accompanied by full teaching notes. The first two strips deal with the historical aspect of gas and are by Dean Chandler (South Metropolitan Gas Company). They are concerned with its development and improvement during the 19th and early 20th centuries. The third strip—by E. G. Stewart (Gas Light and Coke Company)—deals with modern Gas Industry. Mr. Stewart is also preparing another strip on the subject.

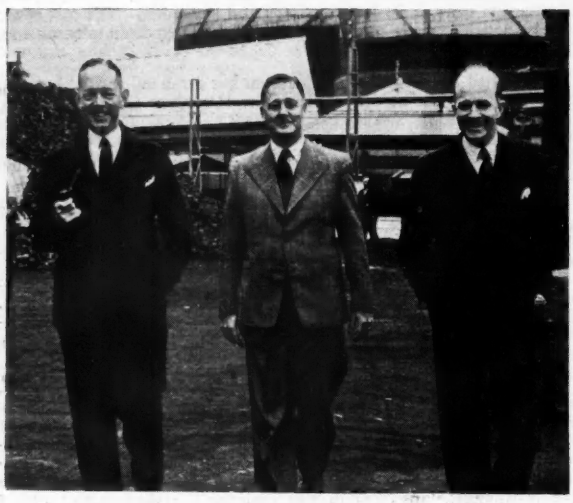
At the Annual General Meeting of the London Branch of the Incorporated Sales Managers' Association at the Connaught Rooms on June 4 Sir Herbert Morgan was appointed President. "Very soon now all of us in business from Chairman downwards will be going out on tour with our little bags and order books," said Sir Herbert. "This does not depress me nor does talk of trade balances and restrictions. Business in this country has the greatest of all assets, a large number of vigorous young men keenly alive to their opportunities and to the need for a new spirit of leadership."

Diary

June 12.—Midland Counties Coke Association: Central Committee, 2.30 p.m., King Edward House, Birmingham.
June 12.—Lancashire and District Coke Association: Annual Meeting and Luncheon, Grand Hotel, Manchester.
June 13.—Federation of Gas Employers: Annual General Meeting of Members in Scotland. North British Station Hotel, Edinburgh, 2.30 p.m.
June 14.—London and Southern District Junior Gas Association: President's Day; Summer Visit to Portsmouth.
June 17.—B.G.C. Joint Consultative Committee, 2.30 p.m.. Gas Industry House.
June 19.—Industrial Gas Development Committee, Gas Industry House, 2.30 p.m.
June 20.—Manchester District Association of Gas Engineers: President's Day; Visit to Blackpool.
June 23.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.; Gas Industry House.
June 25.—B.G.C. Domestic Development Committee, 10.30 a.m. Gas Industry House.
June 26.—Southern Association of Gas Engineers and Managers: Summer Meeting, Finchley.
June 26.—Yorkshire Junior Gas Association: Visit to works of Derbyshire Silica Firebrick Co., Ltd., Friden, 12 noon.
June 27.—Waverley Association of Gas Managers: Annual Meeting, Y.M.C.A. Hall, South St. Andrew Street, Edinburgh, 10.30 a.m.
June 30.—Annual Meetings of British Commercial Gas Association, 2.30 p.m.; National Gas Council, 2.45 p.m.; British Gas Council (Incorporated), 3 p.m.; Federation of Gas Employers, 4 p.m. Gas Industry House.
July 3.—Solid Smokeless Fuels Federation: Executive Committee, Dorchester Hotel, Park Lane, W.1, 11.30 a.m.

Southern Association Visit to Taunton

Members of the Southern Association of Gas Engineers and Managers (Western District) and their ladies were the guests of the Taunton and District Gas Company (of which this year's District Chairman, Mr. L. P. Ingram, is General Manager) on May 15, when an inspection of the works was followed by luncheon at the County Hotel. Mr. W. H. Bennett, Chairman of the Company, presided, and the guests included Mr. V. Collins, M.P. for the Taunton Division, the Mayor and Mayoress (Councillor and Mrs. S. Goodman), and Colonel E. R. Clayton, Chairman of the Somerset County Council. Following a short speech of welcome by the Chairman, acknowledged by Colonel Clayton, Mr. F. Dawson, President of the Southern Association, who is an Old Boy of Queen's College, Taunton, proposed "The Borough of Taunton," and the Mayor, responding, congratulated the local Gas Company on the fine reconstruction of its works.



The Mayor of Taunton (Councillor S. Goodman), Mr. L. P. Ingram (District Chairman) and Mr. F. Dawson (President of the Southern Association) at the Taunton Works.

Mr. V. Collins, proposing "The Southern Association," said the Government had declared its intention of bringing the Industry under public ownership, and he was glad that the Industry has expressed a general spirit of co-operation. The welding together of all the undertakings into one integrated whole would call for the utmost effort, loyalty, understanding and initiative from all engaged in the Industry. He was confident that the tradition which existed in the Western District, whereby they had arrangements for the dissemination of information and for mutual co-operation between the members of the 75 undertakings in the area, would prove an invaluable framework on which to base the future organization of the Region.

Mr. Ingram, who responded, said those in the Gas Industry thought there should be a much stronger connexion between them and the Government, as in the perfect marriage, on more or less equal terms. They had no desire to see Mr. Shinwell adopting the role of the hen-pecked husband, nor did they wish to be the down-trodden wife. There was increasing evidence that many of the powers that be—except, perhaps, a few extremists, who in England, thank God, did not matter a tinker's cuss—were beginning to realize that partnership with Industry was better than dictatorship.

He thanked the Directors of the Taunton Company for their welcome and hospitality, which had helped in making the day for him a red-letter one. He mentioned that much of the credit for the successful reconstruction of the Taunton Gasworks was due to Mr. F. H. G. Higton (Engineer).

Mr. R. C. Taylor (Torquay) toasted "The Taunton and District Gas Company," and traced its 123 years' development. He said the Company's water gas plant, which members had inspected that day, was regarded as a model by technicians both in this country and on the Continent. The Company's sale of 460 million cu.ft. of gas last year was a six-fold increase since the beginning of the century.

Mr. A. C. Mole replied for the Company and paid a tribute to Mr. Ingram, its General Manager.

Inspection of New Stoke-on-Trent Extensions

The May Meeting of the Stoke-on-Trent Gas Committee was held at the Etruria Gas-Works, to enable members at the conclusion of the business to inspect the large scheme of extensions to the works which were authorized by the Ministry of Fuel and Power in December, 1943, and June, 1945, the first stage embracing plant for the production of 2 million cu.ft. of gas per day, and the second, 4 million, making the total of 6 million cu.ft. per day which has now been completed.

The total cost of the extensions is about £350,000, but further new plant has since been sanctioned, comprising a 5 million cu.ft. waterless gasholder, 8 million cu.ft. per day oxide purification plant, and a 6 million cu.ft. per day carburetted water gas plant, which bring the total cost of these extensions up to practically £750,000. This work is now proceeding.

The Gas Committee, under its Chairman, Alderman Percy Williams, J.P. (Deputy Lord Mayor), was honoured with the company of the Lord Mayor (Alderman H. Leason, J.P.), and was joined by two ex-Chairman of the Committee (Mr. A. E. Hewitt, M.G., J.P., and Mr. A. Pemberton, J.P.), both of whom were closely connected with the new plant when it was first discussed and considered some years ago.

The Gas Committee had also invited principals of the contracting firms to join them in their tour of inspection, and Sir Frederick J. West, G.B.E., J.P., represented West's Gas Improvement Co., Ltd., of Manchester, the contractors for the carbonizing plant, and Mr. D. M. Henshaw represented W. C. Holmes & Co., Ltd., of Huddersfield, who installed the electrostatic detarrers, ammonia washers, connecting gas mains and the exhausters.

The first section of the extensions now completed was put in hand by the Gas Committee during the latter years of the war, in view of the envisaged very high demands for town gas on account of the increased activity of the pottery and allied industries, and the tendency towards modernization of the firing processes, embodying the increased use of town gas-fired tunnel ovens.

That this has been more than justified has been borne out by events, and the persistence of the Committee's applications to the Ministry of Fuel and Power during the war period in obtaining sanction to proceed with these extensions has shown a foresight for which both domestic and industrial consumers should be extremely grateful.

To have met a considerably increased domestic consumption, which is now over 70% greater than pre-war days, and also an unprecedented demand for industrial gas during the past winter, without any restrictions in supply attributable to the Department (those which were enforced were only slight and were carried out on the express instructions of the Ministry of Fuel and Power) is also a great tribute to the Gas Committee.

Alderman Williams congratulated the contracting firms on the way in which the work had been carried out and thanked Sir Frederick West and Mr. Henshaw for their assistance.

The Lord Mayor congratulated Mr. J. E. Stanier (City Gas Engineer) on having put Stoke-on-Trent on the map so far as the Gas Industry was concerned. Stoke-on-Trent was now the third largest municipal gas undertaking. Thanks to the Committee, the Engineer and the staff of the Department, the gas-works were second to none.

Sir Frederick West and Mr. Henshaw expressed thanks to the Committee and Mr. Stanier for the manner in which they had been treated during their work at Etruria, and said they were pleased to have been associated with the undertaking.

Following the Increase in Purchase Tax on gas cookers, the charge for hire of gas cookers in Grangemouth municipal houses has been increased from 6d. to 10d. per week. Grangemouth Town Council, the local Trades Association, and the local Socialist Party intend to protest to the Chancellor of the Exchequer the imposition of the tax.

Falkland, Fife, is threatened with a total gas shut-down, and the Ministry of Fuel and Power has been asked to intervene. Mr. G. R. Steven, proprietor of Abernethy Gas Company and owner of the local gas-works, has informed the Town Council that the high price of coal has prompted his decision to cease making gas. The possibility of installing electricity immediately in all Council houses was considered, but Dean of Guild Anderson pointed out that even if this could be done, it would not aid the many occupants of privately-owned houses who would still be relying on gas. It was agreed that the Clerk should write the Ministry of Fuel and Power, stating the facts fully and asking the Ministry to intervene. Falkland is almost entirely dependent upon gas for lighting and cooking, electricity being installed in very few houses. The Council Chambers and streets of the Royal Burgh are lit by gas.

Post-War Reconstruction and Expansion in Belgium

WITH the annual report and accounts the Imperial Continental Gas Association has issued a brochure giving an interesting account of its post-war reconstruction and expansion activities in Belgium. Since Belgium was liberated in 1944 a great national effort has been made to repair war damage, to make good the lag in repair and construction work which was caused by the years of occupation and to provide for the anticipated needs of an expanded peace-time economy.

In common with most Belgian industrial undertakings, the Association's affiliated Companies have been facing these three main problems with energy and, despite the universally difficult supply position, extremely good progress has been made.

Apart from severe damage to gasholders, which are particularly vulnerable to air attack, war damage to gas and electricity installations was comparatively light. The main problem has accordingly been to provide for the greatly increased demand for gas and electricity. As the Association's interests in gas are more important than in electricity it is the provision of new gas producing and distributing plant which has provided the principal material and financial problem.

Antwerp was at one time a main centre of gas production. The Antwerpsche Gasmaatschappij now receives gas in bulk, but its many gasholders are still used for storage and distribution and these suffered considerable damage chiefly from flying bombs and rockets launched by the Germans from Holland in December, 1944, and January, 1945, but also to a considerable extent from Allied air raids. Water gas is still produced at Antwerp as an emergency measure.

The two gasholders at Berchem were severely damaged by flying bombs, a 32,000 cub.m. holder in December, 1944, and a smaller one of 18,000 cub.m. in January, 1945. The latter was repaired and put into service again by June, 1946, while work on the repair of the larger holder is now nearing completion. The cost of putting both holders back into service amounts to £76,400.

At Schoten, a gasholder with a capacity of 50,000 cub.m. was damaged in an Allied air raid in June, 1943: 46,400 cub.m. of gas went up in flames and the three tiers collapsed inside the holder. Repairs were completed in 1944 at a cost of £15,100. In May, 1940, a 10,000 cub.m. dry gasholder at Massenhoven which formed a prominent landmark less than a mile from the Albert Canal was blown up by Allied troops. The damage being beyond repair, a new wet holder of the same capacity was constructed at a cost of £16,000 and taken into service in May, 1946.

Antwerp Development

To cater for development in the Antwerp area, the erection at Berchem of a large holder with a capacity of 80,000 cub.m. was authorised in October, 1945, at a cost of £116,500 and work on this is now well advanced.

Considerable damage was done to the network in Antwerp and the surrounding communes as a result of defence works constructed in 1940 and again from Allied air raids in 1943. Finally came the heavy V1 and V2 bombardments at the end of 1944 and beginning of 1945, with the result that the Antwerpsche Gasmaatschappij had altogether to effect repairs to its principal mains in 363 places at a cost of some £18,200, to which must be added the cost of repairs to the public lighting system and to meters and meter connections estimated at a further £36,800.

In the Brussels area, the gas and electricity networks of Electrogaz and Provinciale suffered damage from German air raids in May, 1940, and subsequently from Allied air raids, the distribution of gas and electricity being interrupted on numerous occasions. At Forest, which lies at the junction of two railway lines, a gasholder was slightly damaged in May, 1940, while in May, 1944, severe damage resulted from an Allied air attack in the course of which 39 bombs fell on the works, a 35,000 cub.m. gasholder being completely destroyed and one of 100,000 cub.m. very badly damaged. The latter was repaired and taken back into service in 1945 at a cost of £29,700; the former will be replaced by a new 100,000 cub.m. holder at Woluwe St. Lambert, for which the plans are nearing completion. Heavy damage was done to other installations at Forest during the same raid, the water gas plant, purifiers and pressure room being among those put out of action. These have been rebuilt since the liberation at a cost of £65,900.

At Nivelles, 17 miles South of Brussels, the Provinciale gas network was damaged in May, 1940, 120 breaks occurring in the mains, 370 consumers' service pipes being destroyed and 620 metres being put out of action. The town of Louvain, where Provinciale had purchased the gas-works in 1941, was heavily bombed in May, 1944, and the works were almost completely destroyed. The two gasholders, each of 15,000 cub.m. capacity, were a total loss. A new 50,000 cub.m. holder is in course of erection at an estimated cost of £73,600.

The coke oven works at Pont Brûlé escaped more lightly than did the distribution companies' installatinos. The works were attacked from the air by the Germans in May, 1940, but serious damage was confined to the 50,000 and 20,000 cub.m. gasholders (the former being set alight), 3 purifier boxes, the sulphate plant and the benzole scrubbers. The total damage from this raid amounted to £6,700, but the works were out of action for only three to four days. Pont Brûlé was attacked again only on one occasion. This was during an Allied air raid in 1944, when incendiaries were dropped. These were scattered over the whole works, but little damage was caused apart from the firing of a naphthalene dump and the partial destruction of the works canteen and one of the cranes.

The programme of reconstruction put in hand at Pont Brûlé since the liberation includes the erection of a new battery of coke ovens at a cost of £283,100. Work on this was begun in July, 1946. With a view to increasing the gas capacity of the works, five new gas producers are being installed at an estimated cost of £198,200.

The Power Stations at Brussels (Droogenbosch and Schaerbeek) suffered little damage during the war, although the Germans did a certain amount of damage to the turbo-alternators at Schaerbeek before they evacuated Brussels in 1944. The total damage amounted to £14,200 but was quickly repaired. Construction of a new power station at Droogenbosch was begun before the war and this is now being completed. It includes a new 30,000 KW turbo-alternator and another of 40,000 KW which is in course of erection.

Long Distance System Damaged

Bombing damaged the mains of the Distrigaz long-distance gas transporting undertaking but the only other damage caused to its installations was by sabotage in August, 1944, when the boosting station at the Anderlues coke oven undertaking (South of Brussels) was crippled. First aid repairs and complete reinstatement cost £13,000.

The works of the Société Chimique de Selzaete were used as a support post during the brief militar yoperation in May, 1940, the works were being shelled and material and products damaged to the extent of £27,200. The laboratory building was totally destroyed, the office building badly damaged and several tar and oil tanks ripped open. The total damage to the works was such that, although repairs and rebuilding were begun as soon as possible, a year elapsed before full activity could be resumed. A new benzole refining plant has been installed and has recently gone into service.

The Matériel et Appareillage pour le Gaz, l'Electricité et le Coke, which sells gas and electrical appliances and kitchen equipment, operated before the war in Brussels and Antwerp. During the war period business was almost at a standstill but since liberation sales have been limited only by the difficulty of obtaining supplies from the manufacturers. The scope of the business has now been extended by the opening of branches or agencies in Ghent, Bruges, Charleroi, Aerschot and Knocke.

The Compagnie Continentale d'Appareils de Mesure, which manufactures gas and electricity meters, water heaters, &c., did not suffer damage from bombardment apart from one attack on its works at Anderlecht, Brussels, in June, 1941, which had only trifling results. On the other hand, its machines and equipment were moved into France on Government orders in May, 1940, and, although never installed in France, were missing for some time until being found eventually at Dunkirk. Some of the special machinery was never recovered and it has not yet been possible to replace it all. The factory is now working to full capacity.

Glasgow Corporation is to seek a revision in favour of municipalities of the Budget imposition of a 66⅔% tax on gas cookers. The Parliamentary Bills Committee has approved an approach to the Government to request that domestic appliances be exempted for municipal housing schemes from the added purchase tax. The effect, in the instance of Glasgow, will be to increase the cost of housing produced in the city in one year by £50,000. Other municipalities are also protesting. Private individuals and municipal buyers are, on the other hand, making no great effort to avoid purchase despite this added tax, on the grounds that purchase is inevitable and, whatever the price involved, must be met. Withdrawal of orders is not regarded as any solution since it would merely lead to delayed delivery to those authorities which adopted the policy. The protests now being made are regarded as the only likely method whereby the cost can be reduced to municipalities.

Practical Progress in Water Treatment

In our issue of May 28, p. 453 et seq we published in full the Paper given by Mr. Philip Wedgwood to the Eastern Association of Gas Engineers and Managers at the Spring Meeting at Chelmsford. The following is our report of the discussion.

MR. **F. Allen** (Clacton-on-Sea) said all were indebted to Mr. Wedgwood for his statement on his experience of the addition of carbonaceous zeolite softening to the lime soda system at the Hemel Hempstead works. "I believe that several of us have had experience of holding calcium carbonate in solution and preventing it being deposited in tanks and cold feed lines by the addition of sodium hexametaphosphate, but to remove it entirely, as the Watford and St. Albans Company have done, by the addition of a carbonaceous zeolite plant has many obvious advantages. Mr. Wedgwood has shown us how this method had been added to an existing lime soda softening system. Although the efficiency of the lime soda plant has been improved by alteration and addition, I think it most unlikely that it is even now as efficient as the more modern Accelerator, Precipitator, or Spiractor plants, but while these may be more efficient, I think we have been shown an eminently practical method of amending our existing plants rather than becoming involved in comparatively high capital costs for complete new installations."

One small criticism he would offer regarding the Paper was that while the Author had mentioned the non-siliceous nature of this material and its consequent incapacity to yield silica to the water being softened, he had not emphasized the advantage that the system he had outlined probably had over straight base-exchange softened water in that sodium bicarbonate was not present in quantity and could not be deposited or add to the corrosion risk. From the analyses of feed water given by Mr. Wedgwood he could see no particular reason why there should be any serious corrosion risk with this water other than the possibly old-fashioned idea that a water of zero hardness was more or less certain to be "hungry."

"I would suggest," Mr. Allen went on, "that at Hemel Hempstead the experience of this water is scarcely sufficient to disprove this ancient theory, but consider that this Association would be even further indebted to Mr. Wedgwood and the Watford and St. Albans Company if we could be told if or not there is any corrosion or pitting when they have had the opportunity of using the water for a reasonably extended period in a boiler where the whole of the shell and the flues or tubes are unprotected by old scale formation.

"I would also be interested to learn whether any special precautions have been taken to prevent admixture of air to this water by faulty pump glands, faults on pump suctions, or possibly open water discharge, as the presence of any free oxygen or air in this water might possibly cause it to be corrosive and cause the water treatment to be blamed for something for which it was not entirely responsible. The Watford and St. Albans Company are to be congratulated on their pioneering spirit in adopting carbonaceous zeolite in the manner described by Mr. Wedgwood, and, as far as I can recollect, it was not before 1941 or 1942 that this material was first described in the technical Press of the water industry. Since that time a second class of organic base exchange materials such as tannin or *m*-phenylene diamine, which are able to give up hydroxyl for the acid radicals and require an alkali for regeneration, have been introduced, but these methods have not as yet been generally adopted in industry and I do not think it unfair to say that zeo-carb softening is still in its comparative infancy."

Thanks were very much due to the Watford Company for their efforts and even more so to Mr. Wedgwood for the excellent manner in which he had given much useful information in a simple manner for their ready assimilation.

Mr. **K. R. Mortimer** (March) remarked that he referred briefly to this process in a Paper given before the Association in 1943, naming it as the "Lime Zeolite Process." In this brief reference the possibility of reaction between any excess lime in the water from the first part of the process and residual CO_2 in the water was stressed. The result of this would be a solid cement-like mass of crystalline $CaCO_3$. The *p*H. value of the water fed to these particular plants would seem to rule out the possibility of free CO_2, and apparently nothing of the kind had been observed. He (Mr. Mortimer) also stated at the time that a considerable amount of technical and laboratory control was required, and he thought it would be useful to know from Mr. Wedgwood the amount of laboratory time spent on the overlooking of these plants. He also wished to enquire whether phosphate treatment had been tried to overcome the slight precipitation of carbonate, or if Mr. Wedgwood could say if any deleterious action would result on the zeolite by its use. This plant had, he believed, now been produced in a combined form by Messrs. Filtrators, Ltd., who were installing plants for the Gas Light and Coke Company.

Mr. Mortimer also asked what method was used by Mr. Wedgwood's laboratory for obtaining *p*H. values. Noticing that he quoted some of them to two places of decimals, the method must be an accurate one. Further, he asked Mr. Wedgwood the total alkalinity of his blow-down water calculated as Na(OH) on waste heat boilers. This was a figure over which some controversy had raged. "My own," he said, "is kept as far as possible below 100 grams/gallon, and even though it does for short periods come much higher, no scale and no corrosion have yet been found. At higher concentrations trouble would undoubtedly be experienced with manljd joints and gun-metal fittings."

A Problem Needing Investigation

"I think the Author is to be congratulated on bringing to the notice of the Industry this new process of water treatment, because I cannot help feeling that this question of water treatment is one which receives too little attention," remarked Mr. **J. Hunter Rioch,** Managing Director of the Cambridge University and Town Gas Light Company. "In his introduction, Mr. Wedgwood asks: "Is it not wrong to look upon steam boilers as chemical reaction tanks in which water treatment processes may be completed?" To my mind this point is not emphasized sufficiently and it is definitely bad practice to allow such reactions to take place which can only impair efficiency with many serious disadvantages. With regard to the effect of this process as found inside the boilers, it is interesting to note that old scale formations are being removed, and it would also be of interest to know whether Mr. Wedgwood has found any signs of embrittlement on points where local concentration of alkaline salts may have occurred.

"It is noted that the Total Solids content of the waste heat boilers is given as 605 grains/gallon. This appears to be high, but it is thought that it is probably due to the descaling effect of the new softening process. Has any difficulty been experienced with priming at the figure given for total solids? Additional points which occur to me and about which I would seek further information are the following: (a) At what pressure is steam raised? (b) Is there any appreciable return of condensate to feed tank and is this de-aerated in any fashion? (c) I am surprised to learn intermittent blow-down is practised. This seems unscientific in a very scientific approach to the problem of water treatment. It must result in unnecessary loss of heat as compared with the continuous blow-down process. Has Mr. Wedgwood any particular reason for adhering to the rule of thumb 1½ in. in the glass per shift?"

Mr. **T. N. Johns** (Lowestoft) said he was interested in the Author's remarks concerning the high factor of boiler availability. This was good advice in many respects so long as it was not carried too far, particularly in the Gas Industry, in that because of the type of fuel (often small coke breeze, and fines containing a high percentage of ash) boiler plant was necessarily put out of action for flue cleaning, even though internal cleaning were eliminated. Perhaps one day the steam boiler load factor could safely be increased if the necessity for internal cleaning could be eliminated altogether, as suggested by Mr. Wedgwood, but in his (Mr. John's) opinion this would have to be coupled with the use of a clean fuel such as gas or oil, thus obviating flue cleaning as well.

Mr. Johns mentioned that the Author described the use of carbonaceous zeolite and referred to it as a synthetic material produced by the sulphonation of coal. The material was given the name of "Soucol." He wanted to know a little more about the material itself. What did sulphonation mean? He supposed it meant treating coal with sulphur, but he might be wrong. Could they know its chemical formula and the chemical equations resulting from its use?

On the question of water softening generally, he mentioned that the Ministry of Health last year appointed a committee to advise "whether it is desirable and if so feasible that public water supplies should be softened in areas where there is a high degree of hardness, the effect of softening on the finances of water undertakings and the resultant cost to consumers, as compared with economies in other directions, the degree of hardness to which water softening is desirable, and the effect on trade and industrial undertakings if softened water is supplied." He mentioned this merely as an indication that the question of water hardness was being investigated by a national committee, and it was possible some recommendations might be made with regard to public water supply composition as to its effect on health, domestic, and industrial needs. A recommendation for softer water would undoubtedly benefit many gas-works taking it from a public supply, but that time might be rather far ahead, so it would seem that prudent engineers would benefit their undertakings by following up the ideas expressed in Mr. Wedgwood's excellent Paper.

Mr. **J. Sharp Smith** (Gas Light and Coke Company) remarked that in the Gas Industry they had many boilers of which they could be proud but, in many cases, the water with which they were supplied was unsatisfactory. There was a distinct demand for what might be termed "quality" water—*i.e.*, water free from hardness, free from any tendency to deposit residual calcium carbonate, of reasonable alkalinity, and carrying reasonable total solids. Such water would, among other benefits, influence fuel consumption advantageously. He would like to ask the Author if he had any information on the behaviour of carbonaceous zeolite when softening water of high *p*H. Was there any possibility of it deteriorating under such conditions ?

Mr. **F. B. Richards** expressed his appreciation of the Paper. Some 30 years ago when waste heat boilers first came into general use they were usually applied to the waste gas from the recuperated gas retort. At the temperature the damage that could occur to the boiler in the case of scale deposit was relatively small. Now waste gas was usually coming into the boiler at 850° to 1,000° C., depending on the rate at which the plant was being worked and the tightness or otherwise of the retorts. Evolution of steam at the inlet end of the boiler was extremely rapid. The first 20-25% of the length of the tube did probably 70-80% of the work. If they did not have water which was well treated there could be very heavy deposit on the inlet. That acted as a very efficient insulator and temperature rapidly developed in the tube plate and tubes, which was dangerous. If there was a leakage they could never get the boiler back to its new condition nor get the tube back as it ought to be. This was an important subject, and he thought they were very fortunate in having the Watford and St. Albans Gas Company pioneering in this way.

The Author's Reply

Mr. **Wedgwood,** in his reply to questions, said corrosion of boilers was due mainly to the oxygen content of the water. When the plant was put in at Hemel Hempstead he had a number of things in mind. There was always the possibility of getting high oxygen. There might have been corrosion from a number of factors. An acid was used, and the thought of putting it into the water was not a pleasant one and had to be given careful consideration. He wanted to see if changing one or two conditions would have any bad effect. He was satisfied, after watching the boilers for two years, that there was nothing wrong with them. The waste heat boiler was purchased second-hand and at the time was in such bad state that they were told they would probably have to put new tubes in it after a time. But they had not done so. The original tubes were still there, and as far as he knew they were in good condition. In his Paper he had referred to Mr. Mortimer's Paper. It was partly because Mr. Mortimer gave such an excellent account of water softening and included all the equations that he (Mr. Wedgwood) did not put anything of that sort in his Paper. "I thought this would be a practical Paper which in conjunction with his would make the picture practically complete," he said.

Regarding the development of putting all the plant into one unit, they had had many interesting discussions. The great point about that was that lime soda softening could be carried nearly to completion in a very short time—in 60 seconds to three minutes. If that could be done there was no reason why it could not be done in a very small tube put inside a circular vessel in which was the carbonaceous zeolite to complete the process.

Supplementary phosphate treatment of the boiler feed water had not been practised. Tests were done on samples of water from the inlet and outlet of the Zeolite Unit daily before regeneration. They did not take a long time and could easily be fitted in to intervals of the regeneration procedure.

In reply to Mr. Hunter Rioch, he said the total solids of 605 were above the limit to which they normally worked, but this was partly because a good proportion of the solids were insoluble. Consideration had been given to continuous blow-down. Nothing had been observed to cause uneasiness in regard to embrittlement. Average boiler pressure was about 100 lb./sq.in., and there was some steam trap condensate returned to the feed tank. No special steps had been taken to de-aerate the water. There had not been any trouble with priming. Regarding the effect on the zeolite of water of high *p*H. value, no bad effects had been observed. In connexion with the manufacture and use of zeolite a number of interesting points had been met with " and we are continuing it as far as we can take it and will possibly write another paper on the aspect of the process." So far as keeping boilers perfectly clean internally and externally was concerned, he was looking forward to the time when boilers would be producer gas fired. He was pleased Mr. Richards commented on waste heat boilers and the developments of carbonization practice and setting design which were bringing about a state of affairs with temperatures of over 900° C. on inlet tubes. He thought some modification of design at the inlet end of fire-tube boilers—not only waste heat boilers—might be made to overcome these difficulties, but the inside of the boilers must be free from scale, particularly on the inlet tube plate.

Proposing a vote of thanks to Mr. Wedgwood, Mr. **F. A. Reed** (Peterborough) said that for many years the water side of their Industry had been the Cinderella. In recent years there had been a tendency to have water softening plants fitted, but they were often left to the foremen and allowed to deteriorate. In the case of the Watford Company, however, this unsatisfactory state of affairs did not exist, and they were to be congratulated on their very progressive spirit. He added that Mr. Wedgwood's Paper had been a model of what a paper should be, and he was interested to hear he was considering giving a further Paper on other aspects of the work. "I hope," he said, "he will cover aspects of water de-oiling and de-aerating."

Mr. **J. Young** (Grantham) seconded and the motion was carried with acclamation.

In reply, Mr. **Wedgwood** said that if his Paper had been useful to them in any way he would feel well rewarded. He added that the plant he had described at Hemel Hempstead was new. At St. Albans they were putting in another about nine times larger.

German and Japanese Industry

More reports on German industry have been released, bringing the total now available to 2,059. Another Japanese report received from Washington is also published. Reports on German Industry are prepared by Allied Industrialists (mainly British and American) selected for their specialized technical knowledge, who were sent to Germany under the auspices first of the Combined Intelligence Objectives Sub-Committee and subsequently of the British Intelligence Objectives Sub-Committee and its American counterpart, the Field Information Agency, Technical.

Reports on Japanese Industry so far received are almost exclusively from American sources and are in most cases compiled by teams of United States Service personnel. Many of these reports are of a preliminary nature and do not go into great detail. Those now released are published in accordance with the Government's policy to place all information which may prove of general interest at the disposal of industry at the earliest possible moment.

Although no invention made in Germany or Japan during the period between Sept. 3, 1938, and Dec. 31, 1945, can become the subject of a valid British patent, some of the information gathered in Germany or Japan may be covered by valid patents or patent applications in the United Kingdom. In order to avoid infringing patent rights, therefore, firms interested in exploiting any particular item are advised to investigate the patents position in the United Kingdom before going into production. Similar investigations are also desirable before exports are made to any particular country abroad.

The Evaluation Reports are short preliminary accounts which have not been included in their authors' more comprehensive final reports. They are available at a uniform price of 2d. each (3d. post free.) These British, American, and other Allied Agency Reports may be purchased from the Stationery Office. Reports are also distributed to the chief public libraries and Chambers of Commerce, to universities, professional and scientific institutions, and to the trade associations concerned.

The Gas Supply Period at Wexford has been increased to 13½ hours a day, due to experiments now being carried out in manufacturing foundry coke from American coal. Present gas hours are 7 a.m. to 1.30 p.m., and from 4.30 to 11.30 p.m., but even during off hours the pressure is adequate. The gas-works are now producing plenty of gas as a by-product of coke, reversing the normal procedure in which coke emerges as a by-product of gas. Since the experiments began, on a first allocation of 20 tons of American coal, 10 tons of coke have been made for the foundries. The gas-works are hoping to get a larger coal allocation and thereby to double their coke output.

Mechanism of Carbonization in Continuous Vertical Retorts*

The Bow Common Experiment 1945/46

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(Gas Light and Coke Company)

THE present Paper provides another example of the extensive information which can be obtained by the technique of quenching a working installation of retorts, a procedure first suggested by Dr. S. Pexton. An earlier experiment in this series was described to the Southern Association of Gas Engineers and Managers by Dr. A. E. Haffner and the Author in 1943 (GAS JOURNAL, 1943, **242,** 713, 748, 777; 1944, **243,** 49). In that instance the quenching water was supplied to five combustion chambers, but not to the circulation chambers above them. Consequently, these took six hours to cool down, the upper parts of the charges carbonized almost to completion and evidence of their structure was lost.

Physical Conditions of Charges and Retorts

The next opportunity to repeat the experiment occurred at Bow Common on No. 2 Bench, which was shut down in April, 1945. The retorts in this installation were of a standard downwardly-heated type with a major axis dimension of 80 in., with no taper, and 10-in. minor axis, expanding to 18 in. at 15 ft. down and then remaining at this width for the last 11 ft. 6 in.

The bench was first put to work in September, 1928, and the monolith was re-set in 1936, with additional re-facing in 1940. Altogether it had been let down cold on nine occasions; it had carbonized approximately 1,050,000 tons of coal, and the results of a test carried out on No. 1 Bench in March, 1928, on Yorkshire coal are given in Table 1.

TABLE 1

CARBONIZING TEST RESULTS

Date of test	Mar., 1928
Type of coal	Yorkshire
Number of retorts gasmaking	32.1
Number of retorts scurfing	1.9
Combustion chamber temperatures °C.—Top	1,380° C.
Bottom	1,180° C.
Coal :	
Tons per retort gasmaking per day	8.395
Ash plus moisture content, %	9.0
Fuel (dry) to producers :	
Tons per 100 tons coal	13.05
Lbs. per therm gas made	3.73
Gas :	
Calorific value—B.Th.U. per cu.ft.	510.1
Therms per ton coal (as carbonized)	78.4
Therms per retort gasmaking per day	658
H.E.V.—Therms per ton coal (as carbonized)	34.1
Gas analysis :	
CO_2 %	3.4
O_2 %	0.5
CO %	13.1
N_2 %	5.7

It was known that many of the retorts in this bench were in very bad condition, but the position of those chosen for quenching was rather limited by the fact that a large diameter pipe had to be run from an overhead water tank, and the vertical manifold, from which branch pipes lead into the heating flues, could only be run down the face of the setting at certain points of the bench.

Retorts 27 and 29 were tentatively chosen, these being third and fourth respectively from the end of the bench on the non-producer side. Waste gas analyses showed the thermal leakage to vary from nil to 6.0 therms per ton for the flues on either side of No. 27 Retort, and from 6.0 to 12.3 therms per ton for No. 29 Retort. The first could, therefore, be said to be in relatively good condition, but the second was not up to the standard desired; however, it appeared unlikely that there would be two other adjacent retorts in better condition, and so these two were definitely chosen for the experiment.

No. 29 Retort was examined on April 9, 1945, after it had been scurfed, a heavy pressure being applied to the combustion chambers. No leaks were visible and the walls appeared to be in good condition. A similar test was made on No. 27 Retort on April 11, and this disclosed one small leak about one-third of the way down on the front wall, and there was still a certain amount of scurf left on the right-hand shoulder of the retort at the top.

From the experience gained in the experiment at Nine Elms, various modifications and improvements were suggested for this second trial. These can be summarized as follows:

1. Use more brick tallies to obtain a more complete record of the relative movements of different parts of the charge. This was important since the retorts now to be quenched were of long major axis, viz., 80 in.
2. Use, in addition, "multi-metal" tallies, as described later, to try to obtain some temperature record in the charge.
3. Provide water sprinkler tubes for *all* heating flues and, during the quenching operation, put the water on to the top one first and work downwards.
4. Leave the waste gas dampers open with the settings on chimney draught, to minimize pressures in the heating flues.
5. Keep the extractors operating for an hour after quenching had started to allow for the time lag in cooling.
6. Introduce water *into* the charge at as early a stage as possible to minimize oxidation.
7. Take gas samples at the retort off-takes during the quenching operation. The analyses of these to indicate cessation of gas evolution and hence the effectiveness of the cooling.
8. Take thermograph record of the gas off-take temperature for twenty-four hours before quenching as an indication of the smoothness of travel of the charge.
9. Take more complete photographic records of the quenched charges, to obtain a continuous picture of the front elevation of the charge.

The extent to which we were able to carry out these modifications will now be considered.

Thirty-nine brick tallies were introduced into each retort during the thirteen hours preceding the quenching. They were put in at three positions across the retorts as shown in Fig. 15. It should be noted that in this, as well as in all other sketches and photographs, the retort is viewed as when standing in front of it, the two retorts quenched being back to back. Table 2 is a record of the introduction of the tallies, the columns headed "Depth down" giving the distances to which the tallies fell before reaching the coal charge in the retort. These figures have been used to obtain the correct distances the tallies travelled in the retort, as explained later.

In addition, twelve "multi-metal" tallies were inserted into each retort at the points shown in Fig. 15. These tallies consisted of 3 in. by ¼ in. iron bolts on to which were threaded squares of different metals separated by asbestos washers. The metals used, together with their approximate melting points, were:

	M.p.
Tin	232° C.
Lead	327° C.
Zinc	418° C.
Aluminium	657° C.
Silver Solder, Grade B	778° C.
Silver Solder, Grade B6	830° C.
Silver	960° C.
Copper	1,084° C.

Photographs of both types of tally are shown in Fig. 1.

FIG. 1.—*Brick and metal tallies*

Since the retorts were downwardly heated with vertical combustion flues, the problem of efficient quenching was relatively simple. A 3-in. diameter pipe was run from a large overhead tank and carried down the non-producer side of the setting at a point between the

* Paper to the Southern Association of Gas Engineers and Managers, May 20

two retorts. On the top of the setting horizontal branch pipes led across in front of the coal boxes, and from these, vertical pipes went down into the four temperature-taking spy holes, one at each corner of the retort (Fig. 2). This water, therefore, entered the combustion flues right at the top of the retorts.

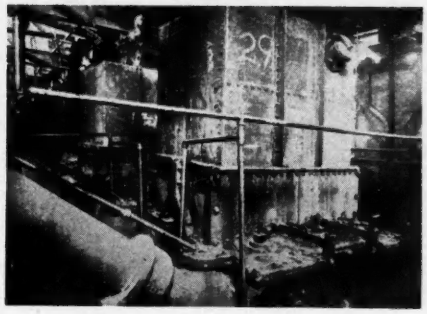


FIG. 2.—*Quenching arrangements—top*

At the side, horizontal pipes led into the setting on either side of both retorts at three levels, viz., the top producer gas distribution flue, the secondary air flue and the bottom waste gas collecting flue (Fig. 3). In addition, steam pipes were fitted to the rodding holes of the gas off-take pipes and to the coke boxes. It will be seen, therefore, that the quenching arrangements were very comprehensive. The description of the actual quenching operation, which now follows, includes the other special innovations.

record was, therefore, kept during the critical twelve hours before quenching. Hourly records of the temperature in the off-take pipe were taken during this time with a mercury thermometer, but these are not really continuous enough to be of much significance.

The procedure adopted during the actual quenching operation is best given by the record made at the time:

April 20, 1945

8.45	a.m.	Auxiliary hoppers two-thirds full; coal slides shut.
9.08	a.m.	Waste gas dampers opened full; producer gas dampers shut and clayed.
9.32	a.m.	Water on to top stage, producer gas cross-over and waste gas cross-over in that order.
10.0	a.m.	Extractor stopped on Retort No. 29.
10.20	a.m.	Extractor stopped on Retort No. 27.
10.25	a.m.	All the above flues were black, but the secondary air flues half-way down the retort still showed red. Water was then put on to these.
11.25	a.m.	Gas off-take valves shut—retorts vented to atmosphere; gas appeared to be very weak.
2.0	p.m.	Top water service into flues removed and water service to charge in retort fitted up. Normal steam to bottom of retort replaced by high-pressure steam.
4.0	p.m.	All water into flues off, but water and steam *into* retorts kept on.

As the adjacent retorts would be hot for several days, water was put on to the top flues of Nos. 27 and 29 for half-hour periods every six hours or so during April 20, 21 and 22 and was finally discontinued at 10 a.m. on April 23. Water and steam were kept on *into* the retorts until April 30.

Gas samples taken at the off-takes before and during quenching were analyzed in a Bone and Wheeler apparatus, and the results show that one hour after quenching began (*i.e.*, five and 20 minutes respectively after the extractors were stopped) the gas was already of a low temperature type. One hour later no coal gas was being evolved. It appeared that the quenching had been rapid and thorough, and this was confirmed when the retorts were subsequently dismantled, no signs of the charges having been over-carbonized or burned being found.

FIG. 3.—*Quenching arrangements—side*

FIG. 4.—*General view during demolition*

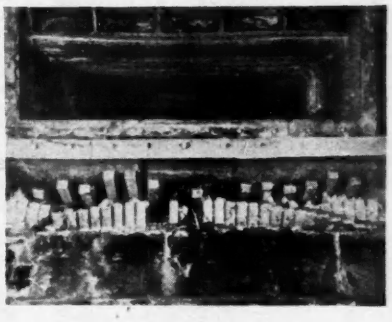


FIG. 5.—*View underneath coke extractor*

Quenching and Dismantling the Retorts

As this bench was working on Yorkshire coal and we were particularly anxious that the quenching experiment should be carried out on a retort carbonizing Durham coal to compare with our first test at Nine Elms, special arrangements were made to supply Durham coal to our retorts for a few days before the shut-down. Samples of this coal were taken when the hoppers above Retorts 27 and 29 were filled on the day before the quenching.

Brick and metal tallies were inserted hourly, from 8.30 p.m. on April 19 at the points already indicated. They were dropped through the rodding holes immediately after the hourly rodding. The distances down from the hole to which they dropped were recorded, so that corrections could be made to the total distance each travelled when the time came to map out the positions of the tallies as found in the quenched charges. The complete record of these measurements is given in Table 2.

Further samples of coal were collected from the tun dishes above the retorts during the night, and sampling of the coke discharged was commenced at 11 p.m. From 5.30 a.m. onwards, a special watch was kept on the coke discharges for any tallies that may have come through the retorts by then.

A thermograph was fixed in the off-take pipe of Retort No. 27, but the bulb was broken off during augering on 19th April and no

TABLE 2

RECORD OF INTRODUCTION OF BRICK AND METAL TALLIES INTO THE RETORTS

Time	RETORT No. 27								RETORT No. 29							
	Brick tally depth down		Brick tally depth down		Metal tally depth down		Brick tally depth down		Brick tally depth down		Brick tally depth down		Metal tally depth down		Brick tally depth down	
p.m.	No.	In.	No.	In.	No.	In.	No.	In.	No.	In.	No.	In.	No.	In.	No.	In.
8.45	1	16	13	12	1	—	25	40	25	36	13	10	1	—	1	27
9.35	2	15	14	12	2	52	26	40	26	33	14	10	2	39	2	25
10.45	3	26	15	15	3	50	27	37	27	33	15	12	3	27	3	27
11.45	4	25	16	12	4	44	28	36	28	24	16	9	4	30	4	22
a.m.																
12.35	5	24	17	12	5	47	29	38	29	21	17	9	5	32	5	21
1.35	6	21	18	11	6	36	30	38	30	21	18	11	6	49	6	21
2.35	7	27	19	13	7	45	31	37	31	24	19	10	7	30	7	21
3.35	8	24	20	13	8	47	32	39	32	24	20	10	8	45	8	24
4.40	9	24	21	12	9	56	33	37	33	24	21	13	9	44	9	21
5.40	10	24	22	12	10	46	34	37	34	24	22	10	10	55	10	30
6.45	11	26	23	13	11	46	35	37	35	24	23*	10	11	37	11	24
7.30	12	24	24	14	12	46	36	39	36	20	24	9	12	35	12	21
8.30	XXX	15	XX	13			X	24	X	—	XX	—			XXX	—

* This tally broke into two parts on insertion.

Owing to the general shortage of gas production plant in the Company, there arose the question of whether this bench might not have to be started up again after all, for use during the 1945-46 season. Consequently it was not possible to start dismantling the quenched retorts until a decision was reached, and this was not until November, 1945. The Contractors then started to demolish the whole setting

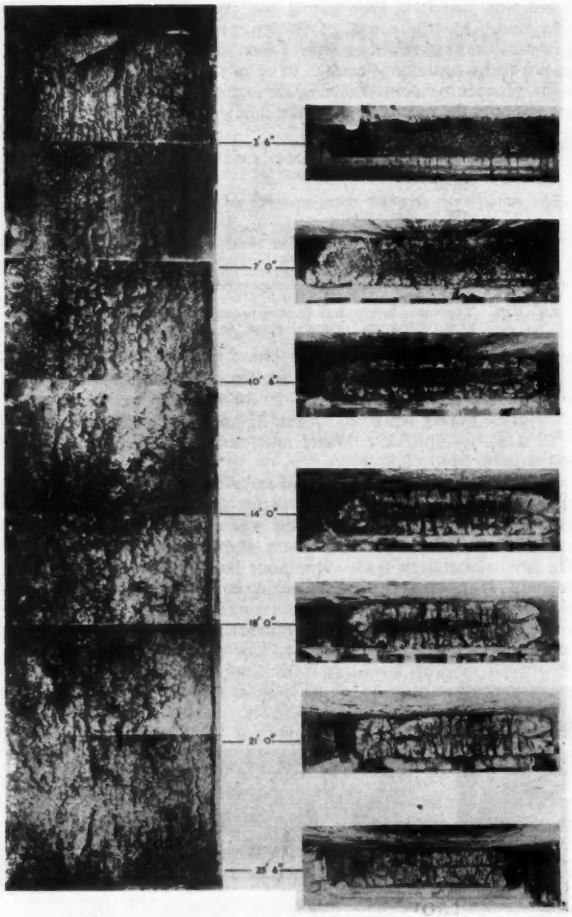


FIG. 6.—*Quenched charges in vertical retorts. Bow Common, Retort No. 27*

and we were able to start on our two retorts on Dec. 11, 1945. Eight weeks were spent on this, the most important part of the work, the last coke being removed from the extractors on Jan. 31, 1946.

As at Nine Elms, the charges were removed piece by piece, a halt being made at each 3 ft. 6 in. level. All vertical measurements were made by means of chains suspended from the overhead coal bunkers. These can be seen in the general view of the site during demolition (Fig. 4). Again, it was particularly noticeable how little the brickwork appeared to have suffered by its drastic quenching treatment. A large proportion required the help of a pick or other instrument for its removal.

A careful watch was kept for tallies and their positions noted; of the 102 introduced into the two retorts, 84 were recovered. Sketches were made of the front elevation and plans at each level and photographs taken, so that continuous pictures of the charges from top to bottom of the retorts were obtained. Unfortunately, it was not possible to place the camera at the same distance from the side of the charge at all levels, and consequently different-sized photographs were obtained.

Enlargements (or reductions as the case may be) were however, made and these mounted up to give the continuous pictures of Figs. 6 and 10. For these photographs I am much indebted to. Mr. J. J. Kelly, Staff Photographer, Beckton, who, in many cases, had to work under very difficult conditions to obtain the views required.

Approximately 36 samples of coal, semi-coke, coke, &c., were taken from each charge, together with a complete 2 ft. section of coke from each retort for measurements of block density.

More complete records were made on the retorts themselves than was the case at Nine Elms. The brick thickness and retort dimensions were measured at each level. Samples of bricks taken from Retort

FIG. 7.—*Variation of scurf thickness with brick wear*

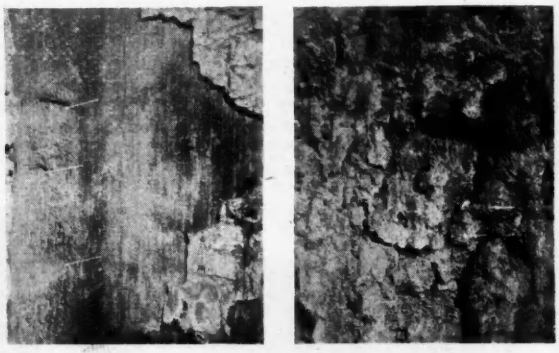


FIG. 8.—*Rubbing spots on scurf and coke*

No. 27, together with some from Retort No. 32, a normally cooled retort for comparison, have been sent to the British Refractories Research Association for examination.

Retort Wear

The dimensions of the major and minor axes and the brick thicknesses at various levels are given in Table 3. In Fig 11 the two curves marked " Retort wear " give the total increase in length of the major axes, and the curves marked " Brick wear " show how much of this increase is due to thinning of the retort end walls. The difference between the two sets of curves is therefore the actual increase in length due to physical expansion. The maximum increase in length occurs at 7 to 11 ft. down, whilst there is a further smaller increase in the

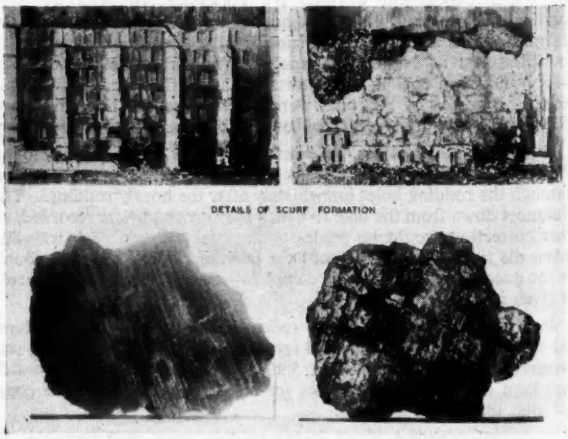


FIG. 9

wear curves between 17 and 22 ft. down. Figs. 12 and 13 show the actual dimensions (not just increases) of the minor axes, both as first constructed and as found on dismantling. Here the maximum increase in width occurs between 4 and 8 ft. down.

Some of these increases must obviously be due to the number of times the setting has been shut down cold, including the two major brick replacements, but it must be noted that the brick wear curves follow very closely the total elongation curves which suggests that, at any rate in part, the elongation is due to excessive pressure of the charge at these levels. A temperature chart of the heating flues is drawn beside the wear curves, and it is significant that the maximum temperature zone is 5 to 12 ft. down. Previously it has been found that the maximum deflection of the buckstays occurs at these levels.

Since these measurements were made, B Bench No. 4 House, Fulham, has been dismantled and the dimensions of three retorts were taken. This is also a downwardly heated setting, and it was found that whilst the point of maximum elongation of major axis was not so pronounced as at Bow Common, it occurred in approximately the same position. It will be interesting to examine an upwardly heated retort, where the zone of maximum temperature is lower down, such as A Bench in Fulham No. 4 House, which will probably be demolished in 1947.

Examination of Figs. 11 to 13 shows that at certain levels the dimensions of the major and/or minor axes actually diminish on descending the retort. This effect is particularly noticeable in the bottom 12 ft. of the retorts where the walls are parallel when new. The maximum wear on the minor axis takes place towards the ends and particularly at the corners, so that the cross-sectional plan is of egg-timer shape; the minor axis measurement at the centre definitely decreases from 14 to 26 ft. down. The implications of this in relation to smoothness of travel will be discussed later.

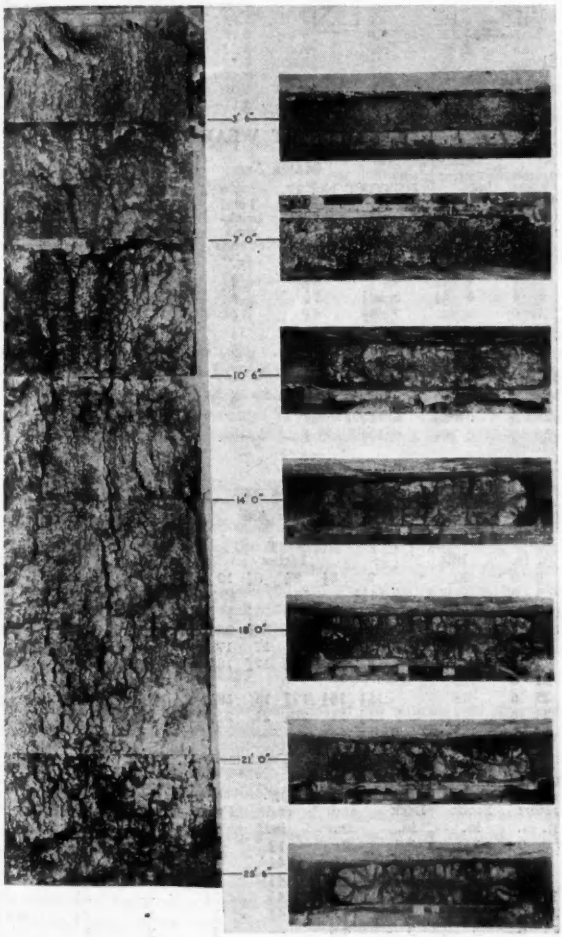


FIG. 10.—*Quenched charges in rertical retorts. Bow Common, Retort No. 29*

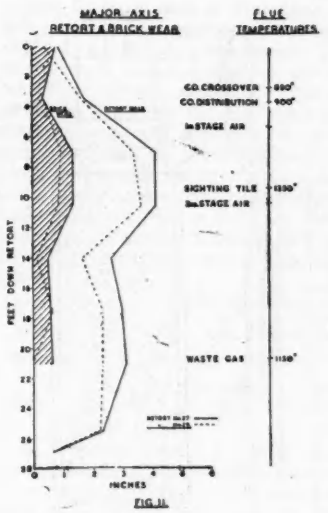


FIG. 11

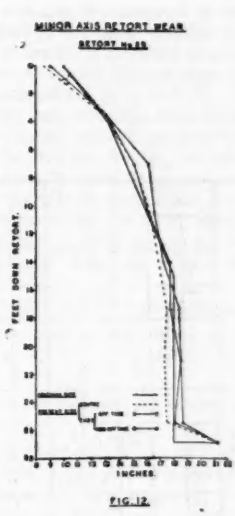


FIG. 12

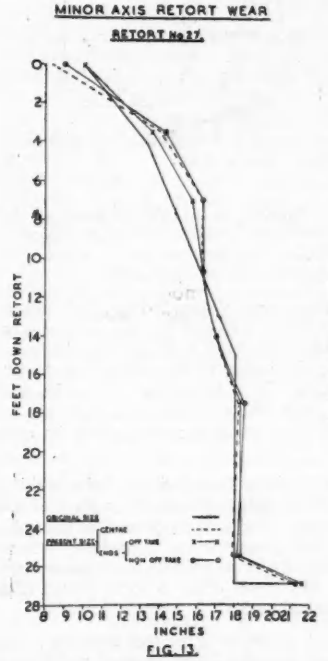


FIG. 13

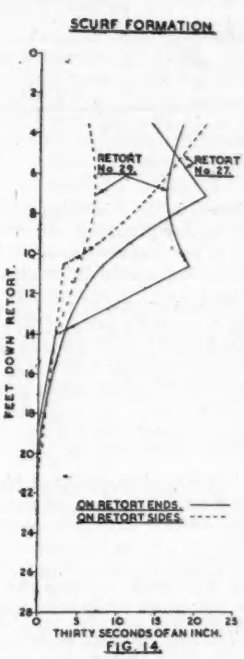


FIG. 14

Scurf Formation

Retort No. 27 had been working nine days and Retort No. 29 11 days from their last scurfing, and so were nearly half-way through their working period. The thickness of the scurf at various levels is given in Table 4, and recorded graphically in Fig. 14. In general, it is greatest at the top, decreasing rapidly down to 12 ft. and then more slowly to 19 ft., after which there was nothing more than a coherent film left. Also the scurf was much thicker at the ends (including the corners) than along the sides of the major axis. This effect was not so great in No. 27 as in No. 29 Retort, but it has already been pointed out that there was a certain amount of scurf left at the top of this retort when it went to work.

This distribution of scurf is very different from that found in the retorts at Nine Elms, where the maximum thickness occurred between 9 and 14 ft. down and was distributed more or less evenly round the whole periphery. As would be expected the maximum scurf deposition is just above the maximum temperature zone in each case, but

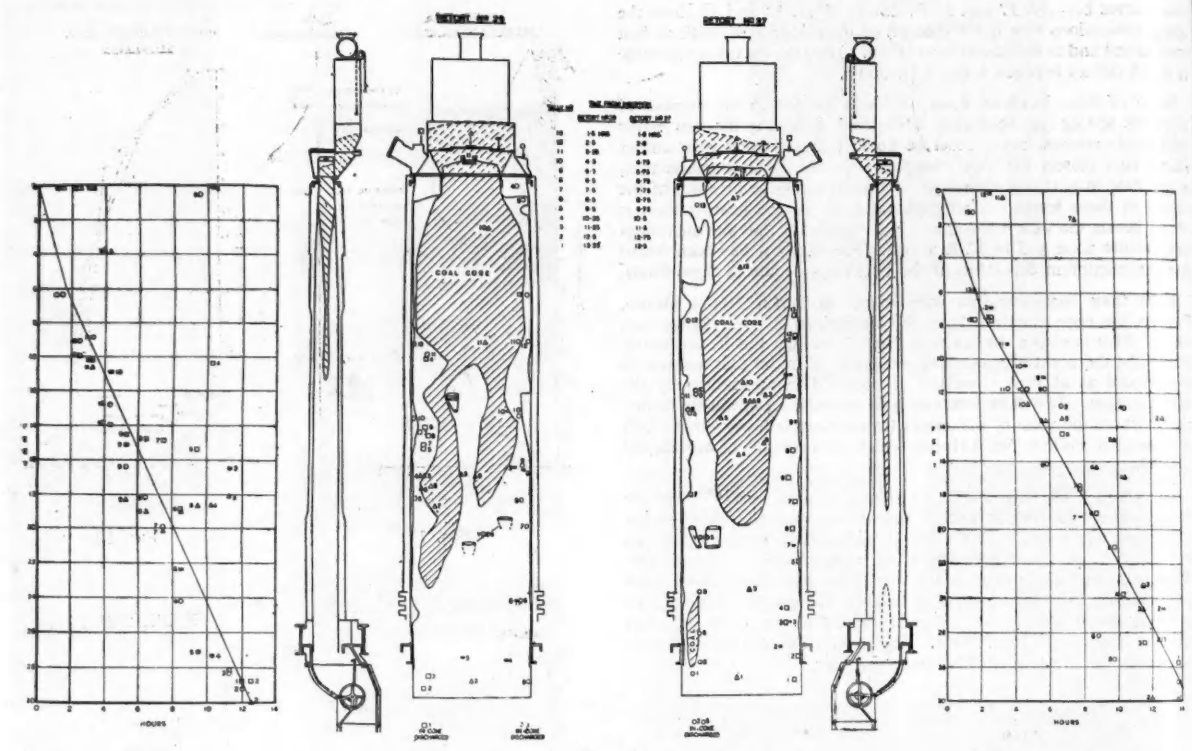


FIG. 15

whereas in the Nine Elms retort there is no preferential travel of the gas up any particular part, in the Bow Common retort the majority of the gas seems to ascend up the ends and corners of the retort, with slightly more scurf being deposited at the off-take end.

Various aspects of scurf formation are shown in Figs. 7, 8 and 9. Fig. 7 shows a portion of the end wall of Retort No. 29, and it can be seen how the scurf builds up where the retort wall has worn badly so that this, together with the abrasive action of the descending charge, produces a smooth inner surface. In point of fact, the coke and scurf are not in contact over their whole surface, and it would be difficult to see how the charge could descend merely under its own weight if this were so.

The two photographs of Fig. 8 give enlarged views of the rubbing spots on the scurf at one end of the retort and on the surface of the coke about 9 feet down the retort. The area of contact of the coke with the scurf is a relatively small proportion of the whole surface. The majority of the surface of the coke is covered with easily removable, soft lampblack, showing that gas travel does to some extent take place over the whole cross-sectional area.

The four photographs in Fig. 9 show the retort wall between 7 and 10 ft. down, before demolition, and the layer of scurf which was strong enough to remain in position after the brickwork was removed; also closer views of a large piece of this scurf after removal. This piece shows the vertical scratches on its inner surface caused by the descending charge and the imprint of the brickwork on the reverse side with flakes of the brick surface that have been detached and are adhering to the scurf.

Carbon Penetration

At Nine Elms, the detection and estimation of the degree to which carbon had been deposited in the retort walls by thermal decomposition of hydrocarbon gases was relatively simple. The uncontaminated bricks or portions of bricks remained cream or buff coloured and the line of demarcation between the contaminated and uncontaminated portions was quite clear. At Bow Common this was not the case; at the top the carbon penetration was 100% and this decreased to zero about 7 to 10 ft. down along the major axis side walls. At the ends, however, the degree of penetration remained high, being 80 to 100% at 11 ft. down. At this level, the brickwork began to be discoloured by ash intrusion and it was impossible to distinguish between the

TABLE 3

RETORT WEAR

MAJOR AXIS

Depth down retort	RETORT No. 27 Length of Major Axis			Total brick-wear at ends	RETORT No. 29 Length of Major Axis		Total brick wear at ends
	Original	Now	Increase		Now	Increase	
ft. in.	ft. in.	ft. in.	in.	in.	ft. in.	in.	in.
0 0	6 6½	6 7	¾	¾	6 6½	¾	¾
3 6	6 8½	6 10½	1¾	¾	6 10	1½	¾
7 0		7 0½	4⅛	1⅛	6 11½	3⅛	1/16
10 6		7 0½	4⅛	1⅛	7 0	3½	¼
14 0		6 11	2⅜	½	6 10	1⅛	⅛
17 6		6 11⅞	3	—	6 10⅜	2⅛	⅛
		to 6 10⅜			*to* 6 11		
21 0		6 11½	3⅛	⅛	6 10⅜	2⅛	0
25 6	6 9⅜	6 11½	2⅛	—	6 11⅛	2⅛	—
26 10 (Iron)	6 9⅜	6 10½	⅛	—	6 10½	⅛	—

MINOR AXIS

Depth down retort	Width of Minor Axis						Width of Minor Axis					
	Original	Now					Now					
ft. in.	In.	Inches					Inches					
0 0	10	9	8½	8¼	8¼	10	10	8½				9
3 6	12⅛	14½		14		13⅛	13½	12¼				13⅛
7 0	14½	16⅜	15⅜	16⅜	16½	15⅜	16½	15½				15½
10 6	16	16½		16½		16½	16⅜	16½				16⅛
14 0	17½	17	17	17	17	17	17⅜	16¾	16¾	16¾	16¾	17⅛
17 6	18	18½	18⅛	18⅛	17⅛	18⅜	18½	17½	17½	17½	17½	17⅛
21 0	18						18½	17½	17⅛	18	18⅛	
25 6	18	18½	18½	17⅞	18	18½	18½	17½	17½	18½	18⅛	
26 10	21½	21½	21⅜	21	20⅜	21	21⅜	21⅜	21	21⅜	20⅜	21½	21⅛

BRICK THICKNESS

Depth down retort	RETORT No. 27 Front	Back	N. Off-end	Off-end	RETORT No. 29 Front	Back	N. Off-end	Off-end
ft. in.	in.	in.	in.	in.	in.	in.	in.	in.
0 0	3½	3.3	2½	1⅜	3⅜	3⅜	2	2½
3 6	5.6	5.8	4⅜	4⅜	5.9	6	4⅜	4.9
7 0	3.3	3.8	4⅛	4½	3.8	3.7	4⅜	4.3
10 6	3⅜	3⅜	4½	4⅜	3⅜	—	4½	4⅜
14 0	3	3	4⅜	4⅜	3	3	4⅛	4.9
17 6	3	3	4.6	—	3	3	5	4⅜
21 0	4⅜	4⅜	4⅜	4½	1.5*	4⅜	4.9	5.2
25 6	4⅜	4½	—	—	—	—	—	5½

* To groove only.

TABLE 4

THICKNESS OF SCURF

Depth down retort ft.	in.	RETORT No. 27 Average thickness of scurf $\frac{1}{32}$ in. Ends	Sides	All	RETORT No. 29 Average thickness of scurf $\frac{1}{32}$ in. Ends	Sides	All
3	6	14	21	20	18	6	9
7	0	21	14	15	16	7	8
10	6	8	3	4	19	5	7
14	0	3	2	2	2	2	2
17	6	1	1	1	1	1	1
21	0		Coherent Film			Film	
25	6		Film				

TABLE 5

BRICK ANALYSES

Sample No.	Depth down retort	Carbon content %
A.3	3 6	2.62
B.4	7 0	0.76
D.2	10 8	1.98
E.2a	14 0	1.85
F.2a	18 0	0.57
G.2	21 6	0.21
H.4	23 6	0.12
J.1	25 0	1.03
Unused brick	—	0.025

TABLE 6

ANALYSES OF COAL SAMPLES

RETORT No. 27

Sample No.	Depth down retort ft.	in.	Ash %	Vol. matter %	B.S.I. index	Swelling power Sheffield test expansion Initial temp.	%	Final temp.
Lambton coal as charged	—		6.8	33.4	8½	416°	67.1	429°
Dean and Chapter as charged	—		3.6	33.2	8½	418°	64.0	431°
5	3	6	3.9	33.1	8½	420°	56.0	445°
7	7	0	4.9	31.0	8½	425°	47.4	440°
15	10	6	3.9	31.8	8½	415°	48.3	430°
22	14	0	4.3	32.5	8½	420°	68.8	440°
26	17	6	4.6	32.9	8½	410°	61.6	435°
35	25	0	5.4	29.2	8½	425°	66.1	450°
36	25	6	5.1	31.3	8½	430°	61.5	440°

RETORT No. 29

Sample No.	Depth down retort ft.	in.	Ash %	Vol. matter %	B.S.I. index	Swelling power Sheffield test expansion Initial temp.	%	Final temp.
5	3	6	5.0	31.9	8½	415°	65.7	430°
6	7	0	5.8	29.8	4		Nil	
15	11	0	5.4	30.9	6½		Nil	
20	14	3	7.1	32.4	8½	420°	38.3	430°
24	14	3	5.2	32.0	8½	410°	63.0	425°
27	18	0	4.0	32.6	9	400°	69.7	420°
31	21	9	4.4	32.3	9	405°	71.3	425°

two effects. Samples of the brickwork from each level were analyzed for carbon by combustion in oxygen and the results are given in Table 5. It should be emphasized that in each case the sample crushed was of black appearance, and the through 72 mesh materials all had a similar grey appearance except A.3 which was blacker and H.4 lighter than the remainder.

The fully contaminated brick, sample A.3, contained 2.6% carbon, very similar to the Nine Elms samples which had 2.4% carbon. On descending the retort the carbon content decreased, and it is probable that the carbon penetration at the end walls was nil about 20 ft. down. (The sample J.1 is somewhat an anomaly.) The average figure for the whole retort would be about the same as at Nine Elms, but the preferential travel of gas up the corners of the Bow Common retorts has given a much more uneven distribution of the carbon penetration.

Bulk Density Measurements

In each retort, a complete cross-section of the charge was removed for examination, at a level where the coal core had disappeared, *i.e.*, about 22 ft. to 24 ft. down. The section was approximately 2 ft. thick, weighing some 5 cwt. By making a large number of measurements of the dimensions of these sections their volumes were calculated. The whole of the coke was dried and weighed and afterwards its apparent density determined by a water displacement method, using about 1 cwt. of coke.

Unfortunately, at no point in Retort No. 29 was there a complete cross-section of solid coke; in the section removed there was a pocket of coal and large parts were friable semi-coke.

In Retort No. 27, we were able to obtain a section as desired. The apparent density of the coke substance is only slightly greater at Bow Common than at Nine Elms, and this is confirmed by the bulk density of the graded coke measured in the usual way on the 80% 1-1½ in., 20% 1½-2 in. mixture. The density of the block of coke in the retort, however, is much greater at Bow Common than at Nine Elms, giving a reduction in void space from 54% to 36%. It should be noted that this void space does not mean the total voids throughout the coke substance, *i.e.*, taking into account the porosity of the coke, but the voids represented by fissures, &c., in the coke block as it rests in the retort. This increase in block density is presumably due to the smaller percentage increase in area in the Bow Common retort than in the Nine Elms retort, at the lower levels. Even so, there appears to be sufficient increase to allow the coke to be formed by horizontal expansion alone, as the following calculation shows:

Area of Retort 3 ft. down—where first complete skin of coke has formed = 7.63 sq. ft.
Area of Retort 23 ft. 6 in. down—where block density sample taken = 10.45 sq. ft.
Bulk density of coal 48.0 lb. per cu.ft.
Coke yield 75.0%.
∴ Coke from 1 cu.ft. coal weighs 36.0 lb.
Hence Bulk Density of coke with no vertical expansion of contraction $= \frac{36 \times 7.63}{10.45} = 26.3$ lb. cu.ft.

As the block density was even higher than this, it would seem that there must have been some contraction in the vertical direction. In the Nine Elms retort, where the increase in area is greater, the void space is higher and the actual density is nearer that predicted. Evidently this leads to easier working and smoother travel of the charge.

Rate of Travel of the Charges

It has already been mentioned that of the 102 brick and metal tallies introduced into the retorts, 84 were recovered, so that a very complete picture of the movements of the charges was obtained. Fig. 15 shows cross-section through the major and minor axes of both retorts. The exact position at which each tally was found is marked, together with their points of entry into the retorts. It should be noticed that in order to make it easier to follow the course of the tallies introduced at any one point, each set has been marked with a distinctive symbol and numbered 1 to 13. The shaded portions represent the unchanged coal core, and the larger voids are also indicated.

The zero level from which all vertical measurements have been made is the bottom of the iron collar forming the top rim of the retort: this was chosen because when this collar was removed, the bricks came away with it, leaving this the natural level from which to start our observations. The distances from this zero point at which the tallies were found have been corrected by means of the readings given in Table 2 to allow for the greater or lesser start they obtained when dropped on to the coal charge at the beginning of their journey down the retort. These corrected distances are plotted on the graphs shown at either side of the retort sections in Fig. 15.

From these we can see that in Retort No. 27 the average rate of travel (neglecting tallies held up or that behaved abnormally in any other way) was 3.5 ft. per hour for the first 7 ft. and 1.83 ft. per hour from 7 ft. onwards. In Retort No. 29 the charge travelled somewhat faster, being 4 ft. per hour for the first 6 ft. and 2.18 ft. per hour after that.

From the throughput (7.8 to 8.0 tons coal per day), the bulk density of the coal (48 lb. per cu.ft.) and the area of the coal core just below the division plates where it enters the retort proper (3.81 sq. ft.) it is easily calculated that the rate of descent of the coal is about 4 ft. per hour. In Retort No. 27, where the coke "block density" measurements were successfully made, a similar calculation shows the rate of travel of the coke monolith at the 23 ft. 6 in. level to be 1.7 ft. per hour. Both these figures agree approximately with those indicated by the tallies.

The residual therms in the coke collected during the night April 19-20 is rather high at 10 therms per ton, showing the throughputs of both retorts to be a little higher than desirable. (A normally carbonized continuous vertical retort coke (contains 5-6 therms per ton by the same analytical procedure.)

The Coal Core

Before proceeding to a consideration of the general distribution of the tallies and the travel of the charges, we will look at the analyses of the various samples of coal taken both before and after the actual quenching. In the discussion on the Paper presented to the Southern Association of Gas Engineers and Managers on the first quenching experiment at Nine Elms, it was suggested that the "coal" found at

the bottom of the core was not unchanged coal as we claimed, but a solution of coal in the pitchy and tarry matters released from the outer layers of coal carbonized higher up in the retort. Further, that the B.S.I. Swelling Index was not sufficiently sensitive to differentiate between Durham coals and any product such as this.

Accordingly, we have used the Sheffield Laboratory Coking Test, a dilatometer swelling test devised by Dr. Mott at Sheffield, to supplement the B.S.I. Swelling Index for our coal samples. We have found this test extremely sensitive, *e.g.*, if the through 72 B.S. mesh sample is dried in an air oven at 105° C. for an hour it lowers the percentage expansion considerably, compared with a sample of the same coal air dried at room temperature for several hours.

Table 6 shows the results of tests carried out on the samples of coal taken from Retorts 27 and 29 respectively. Dean and Chapter coal had been elevated to the hoppers on April 18, and Lambton nuts on April 19. The ash contents of these were very different but no definite conclusions as to which coal entered the retorts can be drawn from the ash contents of the individual samples at different levels, since the amount of each sample collected was small (say ½ to 2 lb.). In Retort No. 27 it would appear that Lambton had entered first and reached the bottom of the retort, followed by Dean and Chapter in the upper portion. In Retort 29, however, the reverse if anything is the case, although in this instance there is no big difference in ash content.

The more important figures are those for volatile matter and swelling index. In Retort No. 27 the B.S.I. Swelling Index has remained at 8½ throughout. The more sensitive Sheffield Test, however, shows that the coal at the 3 ft. 6 in., 7 ft. and 10 ft. 6 in. levels has suffered some deterioration, but below this level the swelling power was relatively unimpaired. In Retort No. 29 the coals at the 7 ft., 11 ft. and 14 ft. levels were affected. two of them to such an extent as to lower the B.S.I. Index considerably. Again at the lower levels the coals were unchanged. The volatile matter contents confirm, in the main, these findings.

To interpret these results it must be remembered that the charges in the retorts were saturated with water to prevent any chance of spontaneous ignition and were then allowed to stand from April until December, 1945. Since the coal could not lose its swelling power in the upper part of the retort and then regain it lower down, it must be that the lower swelling power in the upper part of the retort is due to oxidation having taken place during the long period of standing. The important point is that coal can pass through practically the entire length of the retort and have its swelling power unimpaired. (Samples 27/35, 27/36 and 29/31.)

In Retort No. 29 pitchy material had refluxed in the off-take pipe and run down into the charge to a depth of more than 7 ft., agglomerating the coal into a solid vertical column. Samples of the pitch-covered coal were taken at 7 ft., and their analyses are shown in Table 5, Nos. 7 and 12. Their low ash and high volatile matter confirm their nature, and a solid mass of coal like this would cause serious hanging of the charge unless well broken up by rodding.

It is convenient at this point to refer to the phenomenon of the plastic layer, which was found to be considerably thinner than had been expected. At all levels of the charge it was possible to remove portions of the outer skin of coke which had lumps of unchanged coal adhering to them. The transition from quite well carbonized coke to unchanged coal was very sharp, and the layer of semi-coke material representing the solidified plastic layer was never thicker than ⅛ to ¼ in., probably nearer to the former.

We will consider the two retorts separately and from the distribution of the tallies determine the movements of the charges, comparing the analyses of the coke samples taken from various positions, with these deductions.

Retort No. 27

The tallies on the off-take side are fairly regularly spaced showing the charge to have travelled smoothly and continuously. Coke samples taken from the off-take side show of Retort No. 27 a regular decrease in volatile matter, increase in abrasion index and increase in apparent bulk density as one goes down the retort, confirming the regular travel of the charge.

On the non-off-take side there is a large void at the top of the retort between the 2 and 6 ft. levels, and from the fact that it is bounded by tallies 12 and 13, was formed between 7.30 and 8.30 a.m., the extract or having been stopped at 10.20 a.m. Tally 13 has been held up by this. The coke sample taken at 5 ft., *i.e.*, from the edge of the void, is abnormally low in volatile matter, while that from 7 ft. is normal for this position. Moreover, the samples of pitchy material taken from under the off-take and non-off-take ends respectively show a wide divergence in composition.

That from the off-take end has a low ash content and a high volatile matter content, *i.e.*, it is coal covered with refluxed pitch. That from the non-off-take end has a high ash and lower volatile matter, due to oxidation during the hold-up period.

It is a matter of common experience that the charge is bright red on many occasions under the non-off-take end rodding hole of these long major axis retorts. A further void appeared between the end wall and the charge from 14 to 18 ft. down, and this had caused a hold-up above it where tallies 8, 9, 10 and 11 were all found near together, these covering a period of over three hours. This hold-up is reflected in the coke sample analyses, that at 11 ft. having an abnormally low volatile matter whilst that at 14 ft. was very high. Proceeding further down, the main coal core ended between 19 and 20 ft., but there were two large voids in the centre of the charge around the 20 to 21 ft. level, and these can be distinctly seen in the photograph of the cross-section at 21 ft. (Fig. 6). At 23 ft. another small pocket of coal appeared, extending down to 28 ft.

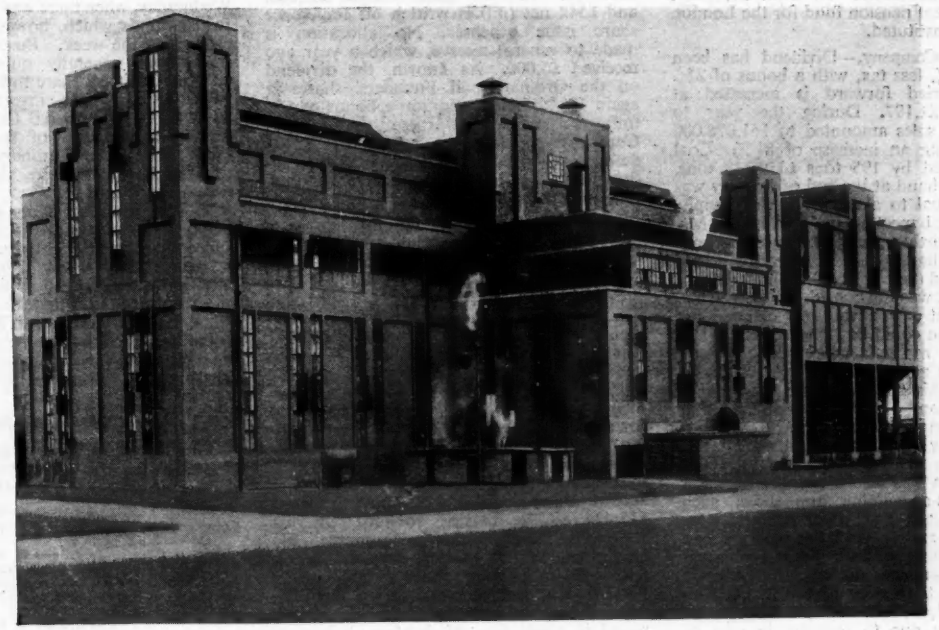
The photographs of the cross-sections in Fig. 6 show that the skin of coke first formed at the ends of the charge has the shape of the top of the retort where it is developed. As this descends the retort and the minor axis increases then either voids are left in the corners or the charge splits in the middle leaving a V-shaped void at each end. The photographs of the 21 ft. and 25 ft. 6 in. levels show, however, the charge filling the whole area of the retort at the non-off-take end with the coal pocket clearly defined to 25 ft. 6 in. It is evident that this coal must have come from the end of the main core, having slipped through the voids mentioned above and carrying tallies Nos. 5 and 6 with it. This coal filled the normal V-shaped void and then on carbonization the pressure developed forced the charge outwards against the side walls and into the corners of the retort. At 23 ft. 6 in. samples of the coke were taken from this end of the retort, but separated into one from the centre of the end and two from the sides of the end The centre coke is abnormally high in volatile matter, showing that it had only recently been formed, but that from the sides is much lower, though still on the high side for this part of the retort. The abrasion index and apparent bulk density confirm the centre coke as being more recently formed than the outside coke.

(To be concluded)

Gas Undertakings' Results

Associated Gas and Water Undertakings.—Total income for the year ended Mar. 31 was £188,907 against £190,101 for the previous year. Profits, struck after providing for debenture interest, taxation, and writing off £1,243, against £4,368 in respect of investments and properties, were £72,777 compared with £64,789. After payment of the usual dividends of 5% on the Ordinary and 6% on the Deferred capital, the sum carried forward is £35,858 against £32,500 brought in. Carry forward and reserve fund for equalization of dividends totalling £60,858 is equal to approximately four and three-quarter years' net dividend on the Deferred stock.

Imperial Continental Gas Association.—The audited statement of accounts for the year ended Mar. 31 shows that the balance to the credit of profit and loss account, after providing for taxation, was £263,883, against £217,393 for the previous year. Of this profit £217,432 was attributable to 1946-47 and £46,451 to previous years. The Directors recommend payment of an Ordinary dividend of 7% and a special dividend of 1½%, less tax, making 8½% for the year. The report states that with the exception of the Les Cokeries du Brabant, which earned a small profit against a loss last year, the principal Belgian Companies paid higher dividends than for the preceding year owing to an improvement in the available supplies of gas and electricity. The arrears of Belgian revenue have now been reduced to Frs. 15,391,504, of which Frs. 11,219,262 is still due from the liquidation of the German Custodian's affairs but its recovery is doubtful. Post-war reconstruction and expansion of the Association's interests in Belgium is the subject of a booklet sent to proprietors with the report. No decision has yet been taken by the Inland Revenue authorities in regard to taxation of war time revenue in France applied to the paying-up of shares in the Compagnie Continentale du Gaz. The French Government has not yet fixed the basis of compensation for foreign



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